BROOKHAVEN NATIONAL LABORATORY

Alternating Synchrotron Department

Review of Potential Environmental Release Points

Accelerator and Experimental Facility

Summary Document

with

Individual Building Area Reports

June 1997

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AGS Potential Environmental Release Points Reports
Summary Document

1. Introduction:

The principle of alternating gradient magnets for synchrotrons was invented at Brookhaven National Laboratory. When the Alternating Gradient Synchrotron (AGS) was built in 1960 it was the premiere proton accelerator in the world. Since that time more than 600 major experiments have been performed at this facility. Three of these experiments have won Noble Prizes in Physics. The AGS has been continuously upgraded and it now provides the highest intensity of protons per pulse and the highest intensity of polarized protons per pulse than any other synchrotron in the world. The AGS also accelerates heavy ion beams for experimental use and for the Relativistic Heavy Ion Collider (RHIC).

The AGS consists of three different accelerating systems: the 200 MeV Linac which is the source of the protons, the 200 meter circumference rapid cycling Booster synchrotron, and finally the 800 meter AGS main ring. The Tandem Van de Graaff accelerator which is a separate facility provides heavy ions for the Booster ring via a beam transfer line. The particles which are accelerated by the AGS facility are extracted into and stopped in various experimental areas located around the ring or sent via a transfer line to the RHIC. Because of the specialized nature of this machine much of the equipment used to run it has been designed, developed, fabricated, and tested by the staff of the AGS Department.

This document will cover the entire facility including: the accelerator tunnels and buildings, the experimental areas both past and present, the various support power supply houses, water cooling facilities, and transformer yards, equipment storage buildings and areas, equipment assembly areas, and technical support shops.

1.1 Executive Summary:

A team of five senior members of the AGS Department was appointed by Dr. D. Lowenstein, the Department Chairman, on April 8, 1997 to study potential and actual source areas from the AGS facility for materials which could cause harm to the environment. In accordance with the guidance document provided by the laboratory committee the team was charged with reviewing the processes, procedures, facilities, equipment, and exterior grounds used by the department which may be potential environmental release points. Members were added to the team to help with the task. For the first two weeks the team studied the buildings within the AGS complex and areas with historical significance. Sixty eight (68) buildings and storage yard areas were identified as being part of the overall AGS facility. Additional active personnel from the department were added to the team as building coordinators or support coordinators for individual buildings or rooms and shops within buildings. Most of the coordinators are senior members of the department and are technical or engineering supervisors in the areas to which they are assigned. Including the coordinators the team consists of more than thirty members.

Appendix A contains the listing of AGS buildings and areas, their priority within this facility, and the coordinators assigned to those areas. Appendix B provides the listing of the AGS Release Points Committee members.

At the same time the committee also prepared an AGS site specific questionnaire. The questionnaire was distributed to all active AGS employees and to AGS retirees. A presentation was made to all the first and second line supervisors explaining the questionnaire and the projects goals. They were made responsible for getting their personnel to complete questionnaires. Appendix C contains the questionnaire and the memo distributed with the questionnaire.

The AGS team received assistance from members of the BNL Department of Advance Technology and from other National Laboratories. The outside support by Technical Support Teams (TST) was first provided on May 7. The AGS building list was divided into four functional groups by priority and divided among the TST's. An additional team was created to help with the search for drawings on the AGS recharge basins, storm water and sanitary systems, and cesspools. Appendix D provides a listing of the TST members and the areas to which they were assigned. The building reports provided by these teams are included in the individual building reports of this document. An additional team was provided by Fermilab to look at ground water issues. Their report which provided information on possible future monitoring programs but little information relative to this effort is included in appendix E.

1.2 Current Facility Description:

The AGS can be divided into two major functional areas: the accelerator facility and the experimental areas.

The accelerator facility consists of the following:

1. Proton source, pre-accelerator, and linear accelerator (LINAC) located in building 930.

2. The accumulator booster ring located in buildings 914 and 942.

3. The AGS accelerator located in building 913. Power supplies, cooling equipment, and technical support shops are provided by many other buildings within the facility.

Experimental equipment and targets have been located in many areas around the AGS ring:

1. Building 912 was the original experimental target area for the AGS ring. Its size has nearly tripled from when the AGS was first commissioned in 1960. Now building 912 contains a proton beam switchyard system which was first built and commissioned in the early 1970's and still serves the facility today.

2. A large asphalt pad inside of the AGS ring adjacent to building 912 also served as an

experimental area in the early years - 1960 to 1970. Three secondary beam lines and their associated detectors were located in this area.The beam 1 and beam 2 lines came from a taget at F-20. The third line which operated in the late 1960's/early 1970's came out at a negative angle from a target at G10. The secondary beam came from targets in the AGS ring in building 912. This area is identified as 913X "inner mongolia". Now it is a storage yard for activated components, it is the location for a transformer yard for the new RF system, it contains some support power supply buildings, and it contains some shops trailers.

3. The "southwest area" (also identified as 913X) was another one of the early external beam lines. It contained both a bubble chamber and a neutrino experiment area which received secondary particles from a target located outside of the AGS ring. This area later became an outdoor storage area with activated components and was filled in when the Tandem to AGS transfer line was built.

4. The north conjunction area (known as beam 3/beam 4) was a beam line for secondary particles which was in service until the late 1970's. The major experimental area there was the bubble chamber located in the building 919 complex. During the 1980's this area became a work and storage area. In the 1990's a new target area and transfer line for the G-2 experiment was built off of the U-line (building 927) which transferred a secondary beam into building 919.

5. The "U line", building 927, was built in the early 1970's to service another bubble chamber experiment and a new neutrino experimental area. A proton target area was located out near the building 927 pump room and power supply buildings. In the late 1970's the U line was extended out to become the transfer line for injection into the ISABELLE now RHIC accelerator.

The other major building in the facility is 911. It serves as the central office building and it also contains the operations control room, many of the technician support shops, a major mechanical equipment room for water cooling systems, and some of the transformers and power supplies required to run the accelerator.

In order to run the AGS complex over 30 MWatts of electrical power is required. This requires oil filled transformer substations which were built to the prevailing industrial standards of the 1950's, 60's and 70's and are presently being upgraded. Pulsed power and RF systems are required to accelerate and manipulate the particle beams in this facility. Special power supplies with oil filled capacitors are required. Still in use are capacitors that were installed in the 1960's and 1970's. Following normal commercial practice of the time some of them contain PCB's. These capacitors have been identified, tagged, logged, and those that are no longer required have been properly disposed of. Some electrical switching gear was and is required which contains mercury. Many of the older units have been removed and properly disposed of and replaced with new equipment without mercury.

Pumps, compressors, vacuum pumps, hydraulic equipment, rotating machinery, etc. are used

throughout the site requiring lubricating and hydraulic oils for their operation. Waste oil was and is disposed of by sending it to the Plant Engineering Department or the Hazardous Waste Management facility. Spills of oil which were not contained went to floor drains or to soil. The floor drains in many of the buildings went to the storm water system before a conversion project was begun in the 1990's.

To cool all of this equipment and dissipate the heat given off by the 30 MWatts of electrical power there are many water cooling systems in the facility. Associated with these systems are the various water treatment chemicals which are typical to any industrial water cooling system. Because the water must also cool magnets in the beam line systems and proton beam targets it becomes activated. The activation is many orders of magnitude less than that of the water used to cool the HFBR but it is high enough to require special attention and care. Spills from the water systems which were not contained went to floor drains or to soil. The floor drains in many of the buildings went to the storm water system before a conversion project was begun in the 1990's.

Most of the components in the accelerator rings and the experimental beam lines become activated. The level of activation varies by location, function, and the time frame when the equipment was installed. Areas in the AGS facility where proton beam targets were installed have significantly higher activation than the rest of the facility. Soil activation is also a consideration though the present target installations shield the soil and the intensity and activation rates were much lower in previous years. Lead, steel, and concrete are used as shielding materials for the facility. These materials have become activated in use and are reused and recycled when new experimental areas are setup. The activated steel and concrete are stored in outdoor storage yards. Soil testing done in these areas does not indicate an environmental concern.

The accelerator equipment is maintained and upgraded by AGS Department staff. In many buildings, machine tools are used, cleaning solvents are common, and activated components are stored for repair or as spares. Trichloroethane (TCA) and other solvents were used extensively throughout the facility for cleaning components. The local practice in New York at the time was that it was a safe solvent to use which could be disposed of by evaporation or by dumping it into a waste oil containers. Most shop and repair facilities had 55 gallon drums of TCA stored for use. How much TCA was dumped in floor drains or on the soil is unknown.

2. Operational Chronology (OC)

The proton intensity per AGS cycle delivered to targets has increased monotonically over the three decades of AGS operation. The per cycle intensity reached 1 Tp (1 Tp = $1x10^{12}$ protons) in the mid sixties. The AGS injection energy was raised from 50 MeV to 200 Mev (commissioning a new Linac) in the early 70's and the intensity rose to around 10 Tp by the mid 70's. Following the introduction of H^- injection (1982) and some RF improvements the complex reached 15 Tp in the early 80's and 20 Tp in the late 80's. After the Booster was added to the accelerator chain in 1992 the intensity increased - to 25 Tp in 1993, 40 Tp in 1994, and 60 Tp in 1995. This remains

the maximum per cycle intensity, reached again in 1996 and 1997 but not surpassed.

The other relevant factors to determining the total number of protons accelerated are the AGS acceleration cycle length and the number of weeks run. A large reduction in cycle length comes with fast extracted beam (FEB) running. In the early 80's FEB with a 1.4 sec rep period was accomplished. The present slow extracted beam (SEB) program runs with a 3.6 second repetition period. The rep rate difference imply a factor of 2.6 in accelerated protons all else equal. The number of weeks per year devoted to running the HEP program has historically been a large fraction of the year, except for shutdowns for major upgrades. This rule has not been followed lately, partly because of the allocation of time to the heavy ion physics program (which from the point of view of activation is very low intensity) and because of budget constraints.

The way the beam is targeted has also evolved over the years. AGS ring locations are relevant in this description. The ring is divided into twelve nearly identical sections (super- periods A through L). These are further divided into 20 subsections each containing an AGS combined function magnet, and the downstream straight section. A target at G10 is a target physically located in the G superperiod downstream of the 10^{th} main magnet in that superperiod. Continuing the targeting discussion; initially the targets were internal to the beam vacuum chamber and generated beams of secondary particles when struck by the circulating beam. Both slow extraction (a long spill from F10 and G10 targets) and relatively fast extraction (a short spill from F20 and I10 targets into Beams '1,2, and 3 ') of secondary beams were in use within the first few years of AGS operation. The first extraction of the circulating beam itself was accomplished in 1964 to the South West area using a kicker at L10 together with septa at A10 and B10. The same scheme, but with I10 replacing B10 as the location of the final septum created "Beam 4", which hit a target just outside the machine at I13. Slow extraction of the circulating beam was developed in the late 60's, using the strategy still followed for present day slow extraction. The beam could initially be sent to only one external target at a time. The slow extraction has become more sophisticated over the years. The present operation allows simultaneous delivery to four primary beam lines.

A new fast extraction system was introduced in the early 70's. This provided beam for transport to the U line via a septum at H10. This final septum location has necessarily stayed at H10 over the years but the kicker initiating the process has moved being located initially at C15, then at H5, and now is at G10. Early U line FEB beam went to the seven foot bubble chamber. Recently a similar system of a kicker (at G10) and a septum (still at H10) has been used to transport protons to the V target again via a piece of the U line.

3. Facility Walk-Down Observations - Potential Environmental Release Points

3.1 General:

Scheduled, "official" walk-downs of the AGS facility by BNL/SCDHS/AGS/DOE teams have not been performed. They will be scheduled for the coming weeks. As discussed in section 1.2 above, most of the buildings in the AGS facility were reviewed by the outside technical support

teams. These teams reviewed the applicable drawings and documentation and did visual inspections of all the buildings to which they were assigned with the exception of High Radiation areas. Since the AGS has been in operation throughout this review time period the acc elerator rings and experimental areas have not been inspected. AGS operation was suspended temporarily to allow inspection of the fan houses by TST members (which have little residual radiation when the beam is off) and to take a water samples.

3.2 Facility Exterior:

Outdoor areas in this AGS facility document are covered under the individual buildings adjacent to those areas. There are outdoor storage areas throughout the facility and they have been identified on the level 3 forms when there is a potential issue. The AGS also has many outdoor transformer yards and those are covered as a separate report. The AGS had and still has many cesspool areas and various storm water basins. A study of the cesspools and storm basins used by the entire AGS facility was done by a TST. The goal was to find undocumented cesspools and storm drains and the storm water recharge basins. It was noted throughout this study that many of the building floor drains emptied into the storm water system. In the 1990's many of these storm drains were converted from the storm water system to the sanitary system. Some still remain and a goal of the follow on effort should be to identify them and modify them where necessary.

3.3 Facility Interior:

The AGS interior space includes beam lines, experimental areas, beam target areas, machine shops, electronic shops, warehouse space, and office space. There are activated materials in the accelerator tunnels and the target areas of the various experimental areas. Other environmental hazards include oil filled power supplies and transformers, mercury, lubricating oil, organic solvents, water treatment chemicals, and antifreeze.

3.4 Summary of Environmental Vulnerabilities:

Table 3.1 is a listing of the potentially significant environmental vulnerabilities presently in existence in the AGS Department and proposed actions to remedy the situation. The table also lists incidents which have occurred and may require further review and monitoring.

Table 3.1: AGS Department Release Points Action Items

Priority	Building #	Room	Type	Description and Actions Completed	Proposed Further Actions	Reported by	Affected
B	911	Mechanical Equipment Room	Cooling Water	Floor drains in the room lead to storm water system. A leak in the AGS cooling water equipment in the room could result in a release of water with as much as 500 uCi Tritium.	Floor drains should be converted to the sanitary water system or diverted to a holding sump so water can be monitored and held if necessary.	E. Dale	E. Dale
C	911	High Bay Area	Mercury	A mercury vacuum cleaner broke while being loaded on a truck at the roll-up door about 1983. S&EP responded to the incident.	Find S&EP report. Determine if further testing is required.	P. Stillman	H. Avent
B	912	Welding Area	Material Cutting	Activated steel has been cut in both the indoor and outdoor facilities. The areas were cleaned and contamination samples were taken after cutting.	Additional samples should be taken at the door drains and the soil near the cutting area. This operation must be reviewed.	A. Pendzick	A. Pendzick
B	912	MPS Control Room	Cesspool	Bathroom goes to Cesspool.	Test Cesspool and convert to sanitary system if necessary. Determine if other bathrooms for the building go to Sanitary or Cesspools.	R. Zaharatos	R. Zaharatos
B	912	Lead Storage Facility	Soil Contamination	In the past lead was stored outdoors on the grounds of the storage yard.	Soil test yard area for lead contamination and radiological contamination.	A. Pendzick	A. Pendzick
B	912	Lead Storage Facility	Storm Drain	A storm drain was found in this area with a pipe leading out to an unknown location. This storm drain does not appear on any of the site maps.	Test the soil in the base of the drain. Determine where the drain goes to.	A. Pendzick	A. Pendzick
B	912	Paint Trailer # 17	Paint thinners dumped on ground.	Paint brushes were cleaned outside of the trailer. Some soil remediation was done in 1993.	Find S&EP report. Determine if further testing is required.	A. Pendzick	A. Pendzick
B	912	Steelyard Storage Facility	Storm Drain	A storm drain was found in this area. This storm drain does appear on the site maps.	Test the soil in the base of the drain.	A. Pendzick	A. Pendzick

Table 3.1: AGS Department Release Points Action Items

A	913	Ring	Sump	The AGS ring sumps are secondary containment for any water which can leak from the ring cooling systems. There is no apparent leak in any of the sumps as determined by level readings taken recently. The water in the AGS ring sumps has been drained.	Line the sumps to make sure they are leak tight.	Dale, E.	Dale E.
A	913	Ring	Sump	The AGS ring sumps are hold any water which can leak from the ring cooling systems. There is no apparent leak in any of the sumps as determined by level readings taken recently. The water in the AGS ring sumps has been drained.	Normal Maintenance procedures will be modified to assure that the sumps are used for secondary containment only.	Dale, E.	Dale E.
A	913	Fan Houses	French Drains	There are french drains which lead directly to the ground. Activated water from the ring chilled water cooling system could get into the drain if a failure occurs.	Install a holding sump. Test drain for contamination	E. Dale	E. Dale
A	913	Ring	Domestic water	Domestic water is routed through the ring for the bathrooms and service use. This water can become activated. Most of the system has been shut down but service is needed for building 932.	Remove the domestic water lines from the AGS ring and reroute building 932 supply. Verify that fire protection systems will not be compromised.	E. Dale	E. Dale
B	913	Berm	Cesspool	The cesspools for the AGS ring will be located and tested. As part of the sanitary water system upgrade these cesspools were removed from service and there has been an effort to find and characterize them.	Locate and test.	Zaharatos	Stillman
B	913	F-R	Polarized Proton Power Supply Houses	Cooling water for the power supply houses is transported through the ring. Water does have a low tritium content.	Investigate cost of rerouting the water system.	Zapasek	E. Dale
B	913	Ring	Bathroom	There is one bathroom in the AGS ring which will be removed. Bathroom could be used as a dump to the sanitary system	Remove facility	Zaharatos	Zaharatos
C	913	Southwest Experimental Area	Cesspool	There was a row of experiment trailers located along the west berm of the area. At least one of the trailers had bathroom facilities. Where the waste water went is unknown. Whether chemicals were dumped in the sink is unknown.	Locate Cesspool(s). Area was decommissioned in the early 1970's.	W. Sims	?

Table 3.1: AGS Department Release Points Action Items

B	914	Basement	Floor Drains	Floor drain presently goes to the storm water system. Booster cooling water could be released to the floor drain during a failure.	Verify the drain goes to storm water system. Change to sanitary system if necessary.	E. Rodger	E. Dale
C	914	annex	French Drains	Old emergency generator room on side of the building has a french drain which could have taken oil and diesel fuel leaks.	Soil test drain.	E. Rodger	R. Zaharatos
C	914	Booster (942)	Floor Drains	Floor drains lead directly to the sanitary water system by laboratory approved design. Activated cooling water could be released to the floor drains during a failure and the sanitary system would act as the secondary containment.	A reminder that this is the system presently in use.	E. Rodger	
B	915	Well Houses 916 and 917 also.	French Drains	Water treatment chemicals could leak into the French Drains.	The drain sumps should be lined for containment.	E. Dale	E. Dale
	915	Well Houses 916 and 917 also.	Water Treatment Chemicals	A posted limit for the amount of chemicals which can be stored in the storage building secondary containment. This is present verbal knowledge. A posted sign will remind the service technician to keep track.	Re-calculate limit and post sign.	E. Dale	E. Dale
B	918	Warehouse	Chemical Storage	There is radiological liquids stored in 5 - 55 gallon containers without secondary containment. Material and storage method may not be in compliance with Suffolk County Regs.	Check material. Put in secondary containment if needed.	SCDHS	J. deBoer
C	918	Warehouse	PCB's	There are power supplies stored in the building with PCB capacitors.	Determine if the supplies are still needed spares. Properly remove and dispose of PCB capacitor which are no longer needed.	TST	J. Sandberg
C	918	Warehouse	Cesspool	There is a bathroom with sink in the north west corner. There is no activity nor record of past activity in 918 which might cause an environmental release. BUT; the cesspool may have served other trailers in the area including a paint shop.	Locate and check Cesspool for contamination.	SCDHS	J. deBoer

Table 3.1: AGS Department Release Points Action Items

A	919	V-line transfer	Cooling Water	Magnet leaks in V-line go to floor drains which go to the 919 sump which goes to the storm system via automatic sump pump. There is significant storm water run-off to the sump. It must be plumbed elsewhere before turning off sump pumps.	Diversion of other storm water is necessary and an OPM proceedure is required for the operation of the sump pump.	E. Rodger	G. Bunce
B	919		Tritium Leak	Release of tritium from gas chronograph detector 10/1973. The detector held approximately 250 mCi of Tritium. How much if any was released at the time is not known. Documentation for this release exists and it was remediated at that time.	Refer to S&EP to determine if remediation performed at the time of the incident is acceptable with today's standards.	E. Rodger	R. Casey
C	919	Compressor Room	Oil Storage	Oil was stored in outdoor yard area. Possibility of spills and leaks exist though none are documented.	Determine if soil testing is required.	E. Rodger	B. Meier
C	919	annex	Fuel Tank	A diesel generator was located outside of building 919. Its location and the location of its fuel tank are unknown.	Locate site and determine if further testing of soil is required.	E. Rodger	?
B	920	E10	Cooling Water	AGS main magnet cooling water is used in building 920. How do we satisfy SCDHS art. 12.	Verify water system used in 920. Satisfy SCDHS requirements	SCDHS	E. Dale
B	920	E10	Power Supply	Two small power supplies (~50-100 gallons of oil in each) are in the building. Oil is stored in a transformer type containment vessel.	Are power supplies still in use? Is secondary containment required?	TST	J. Sandberg
B	922	Technician Shop	Floor Drains	Floor drains, sinks, and the cooling water system drained into a cesspool and an open recharge basin. The cesspool has been removed and some soil has been removed from the basin as the result of a cooling water spill.	Further monitoring of the 922 north recharge basin is warranted based on the cleaning solvents and water system chemicals which were used in the building.	Kobasiuk, TST	Kobasiuk
	923	E787	Pit	A pit with a sump pump is located under equipment for experiment 787. The equipment contains 4 gallons of oil which could be released to the pit in the event of a failure. The pump discharges directly to the storm water system.	Plans are underway to reroute the pump from storm to sanitary.		

Table 3.1: AGS Department Release Points Action Items

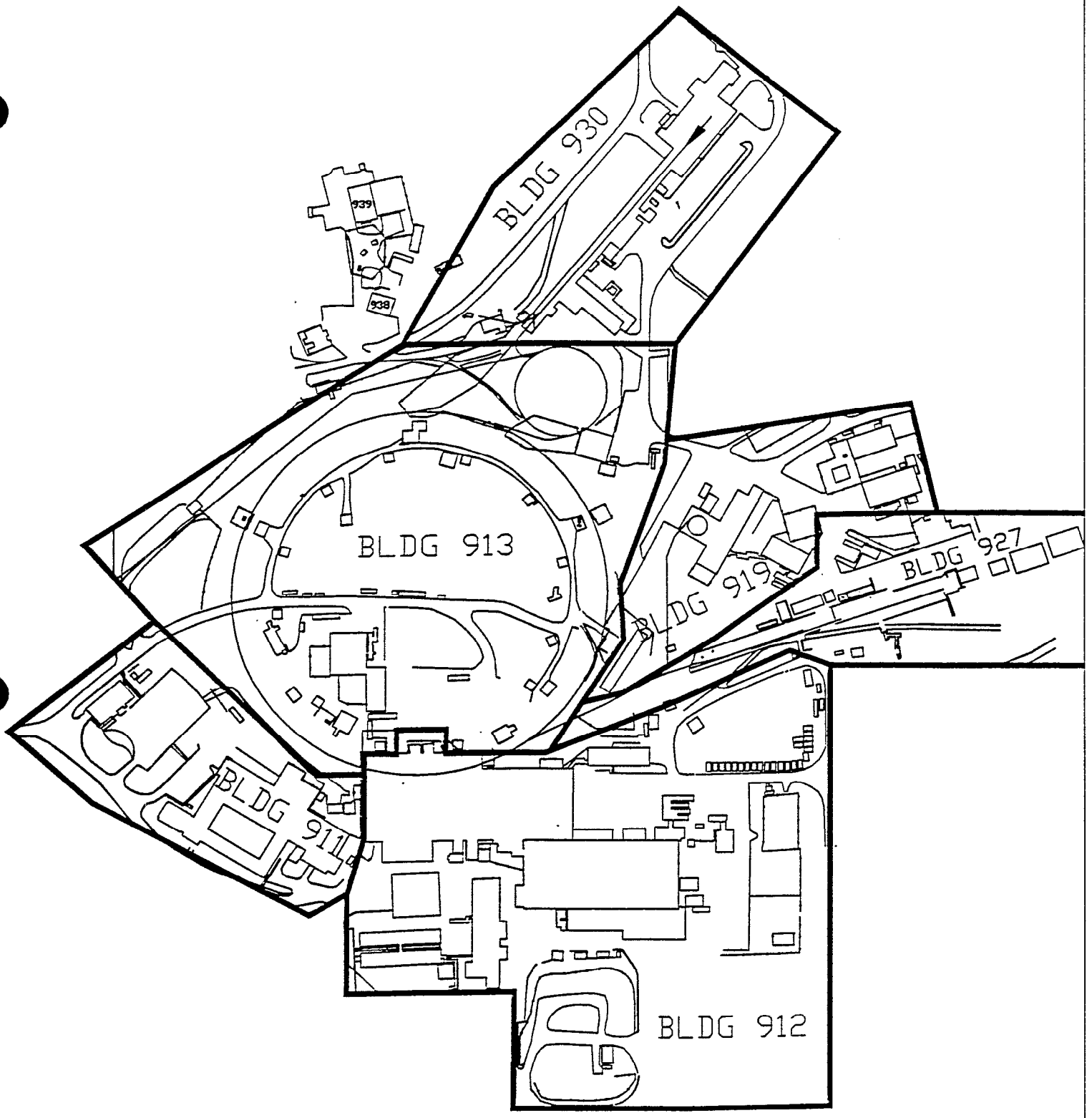
	923	HEEP	Cesspool	Pipes leading into the ground indicate that a Septic tank or dry well may be located north of the building. A review of the building drawings did not indicate where it may be located.	Trace the route of the pipes. Test and remove cesspool if it exists.		
C	925	RF Shop	Floor Drains	Trace where floor drains go. Information is not clearly available from building drawings.	Trace floor drains.	TST	Laloudakis
B	927	U-Line Tunnel	Trenches	The tunnel floor drains have been converted to the sanitary sewer system but, floor trenches drain to storm water system. A leak of magnet cooling water could release activated water to the trenches instead of the converted floor drains.	Reroute trench drains to the sewage system.	Pendzick	Pendzick
B	927	Neutrino Beamline Area	Cooling Water	Leaks and evaporative losses in the neutrino horn cooling system between 1973 and 1983 released an estimated 16mCi of tritium and 7 microcuries of Na22 to the air, soil, and storm water system in that area.	Further monitoring of that area may be warranted.	W. Sims	A. Pendzick
B	927	Neutrino Beamline Area	Lead	Lead wool and sheets was used for shielding. The lead has since become highly oxidized. It has been vacuumed up and removed but some of it may have been lost to the floor drains.	Is further monitoring of the floor drains needed?	A. Pendzick	A. Pendzick
B	927	Radioactive Equipment Storage Blockhouse	Activated Component	The neutrino horn and its associated components are stored in the house. Efforts are underway to dispose of this equipment. For ALARA reasons a long cool down has been required.	After disposal the floor will be tested for contamination.	A. Pendzick	A. Pendzick
B	928	Basement	Oil/TCA release	>100 gallons of oil and >90 gallons of TCA were released to the storm water system via the floor drains on 3/14/73. At that time the AGS storm water recharge basin was at the end of the U-line (927 basin).	Is further monitoring of the recharge area needed?	M. Clancy	
B	929	MER	Cooling Water	Piping for the Experimental Magnets system runs underground. The water is slightly activated - 5.5 x 10-7 uCi/ml.	Move piping above ground if necessary.	E. Dale	

Table 3.1: AGS Department Release Points Action Items

B	930	BLIP Beam Stop	Cooling Water	Leaks in the system in 1982 and 1983 release 1mCi of Tritium to the ground. Possible leak in system storage tank which has been removed.	Well monitoring may be required in that area.	E. Dale	
B	930		Cooling Water	Floor drains lead directly to the storm water system. Activated cooling water could be released to the floor drains during a failure.	Floor drains should be converted to the sanitary water system or diverted to a holding sump so water can be monitored and held if necessary.	V. LoDestro	
B	930	LINAC	cesium	Cesium vapor is produced as a result of the Linac Source operation as cesium oxides or cesium hydrides. (~5 to 10 grams/year)	Is the cesium a hazard?	LoDestro	LoDestro
B	930	LINAC	Lead	Lead blocks and lead wool has been used for shielding in the Linac tunnels. The lead has become activated with use.	Testing of the floor drains may indicate if there is a problem.	LoDestro	LoDestro
B	930	LINAC	PCB's	A capacitor leaked in the building in 1986. Documentation from the company indicated that it was not a PCB oil capacitor. Later tests in 1994 indicated that some capacitors of this type did contain PCB's.	As a precaution test spill area for PCB's	LoDestro	LoDestro
C	930	B	Floor Drains	2 floor drains in the building go to the recharge basin north of building 930. Also cooling water from the domestic water system also goes to the floor drains. Estimate4 gpm when system is operating 5 months/year.	Is a SPEDES permit required for the cooling water. Convert the floor drains to the sanitary system.	W. Hensel	W. Hensel
B	932	F10 house	French Drains	There are french drains which lead directly to the ground. Activated water from the F10 power supply cooling system could get into the drain if a failure occurs.	Install a holding sump. Test drain for contamination	E. Dale	E. Dale
B	949	V-line target building.	Cooling Water	Check if target cooling water system in 949 has secondary containment.	SYSTEM WAS CHECKED SECONDARY CONTAINMENT IN PLACE. **ACTION COMPLETE**	A. Pendzick	C. Pearson

Table 3.1: AGS Department Release Points Action Items

B	949	V-line target building.	Cooling Water	Check target cooling water for activation. This is a new system data is required.	Check target cooling water for activation.	A. Pendzick	C. Pearson
B	965	Neutrino Beamline Area	Oil Piping and Cooling Water	There has been cooling water and oil leaks in this area from the experiment operation. They have been reported and remediation has been done. There are still some pipes in the ground.	Investigate whether further monitoring is required and if the pipes contain any oil.	C. Pearson	C. Pearson
	965	Neutrino Beamline Area	Cesspool	There is a cesspool in the area which served the experimental area. It is not on the site drawings.	Add the cesspool to the site drawings. Test and remove cesspool if necessary.	C. Pearson	C. Pearson
C	SREL	Magnet Stored at the Railroad Yard	Anti-freeze	Is there antifreeze in the magnet cooling water lines which could spill to the ground if care isn't taken?	Check cooling lines and drain if necessary.	A. Pendzick	A. Pendzick



AGS COMPLEX

Appendix A
List of AGS Buildings and Areas
(Includes Historical Areas)

Building Number			DESCRIPTION	Year Built	Building Coordinator	Support Coordinators	AGS Priority	TST Grouping
911	A	911	Assembly	1956	Stillman	Zapasek, Gill, Hoey	A	2
911	A	911	Lab	1956	Stillman	Zapasek, Gill, Hoey	A	2
911	A	911	Offices	1956	Stillman	Zapasek, Gill, Hoey	A	2
911	A	911	Vac Lab	1956	Stillman	Zapasek, Gill, Hoey	A	2
911	A	911	West	1956	Stillman	Zapasek, Gill, Hoey	A	2
911	A	911	Westinghouse	1956	Clancy	Bannon	A	2
911	B	911	Offices	1956	Piper	Advent	A	2
911	B	911	Old	1956	Piper	Advent	A	2
911	C	911	Lab	1956	Kohler	Advent	A	2
911	C	911	Offices	1956	Kohler	Advent	A	2
911	X	911	Mechanical Equipment	1956	Dale	deBoer	A	2
911	X	911	Transformers	1956	Spinner		A	5
925		911	RF Shops	1967	Laoudakis	Sanders	C	5
912		912	Experimental Floor	1958	Carrol	Pendzick	A	2
912		912	Shop/Off		Carrol	Pendzick	A	2
912		912	Trailers		Carrol	Pendzick	A	2
912		912	Blockyard		Carrol	Pendzick	A	2
912		912	Steelyard		Carrol	Pendzick	A	2
912		912	Hazardous Waste Area		Carrol	Pendzick	A	2
912	A	912	Mechanical Equipment		Dale	deBoer	A	2
912	A	912	Cooling Towers		Dale	deBoer	A	2
912		912	Trades Trailer Area		Hubbert	Pendzick	A	2
922		912	Machine Shop	1963	Kobasiuk	Wade	A	2
923		912	Electronic Equip. HEEP	1964	Sandberg	Sims, Sanders, Casper	C	5
940		912	Data	1980	Popkin	Gould	C	2
966		912	Beam Analysis E935	1983			B	5
913		913	AGS Tunnel	1957	Zaharatos	Van Asselt	A	2
913	A-E	913	Fan House	1957	Dale	deBoer	A	2
913	F-R	913	PP PS House	1957	Zapasek		A	2
913	H10	913	Extr. PS	1957	Zapasek		A	2
913		913	Inner Mongolia	1957	Glenn	Rodger	A	2
913		913	Southwest Exp. Area		Sims	Glenn	A	2
914		913	Booster PS/Old Linac	1958	Rodger	Zaharatos	A	4
920	E10	913	PS	1971	Zapasek		B	5
928		913	MG Power Supply	1969	Bannon	Clancy	A	4
929		913	RF Power Supply	1969	Sanders	Laloudakis	A	4
929		913	Pump Room	1969	Dale	deBoer	A	4
932	F10	913		1971	Zapasek	Eld	B	5
942		913	Booster Tunnel	1987	Zaharatos	Gardner	B	4
628		919	Liquid H Facility	1965	Hildenbrand	Meier	C	
904		919	North	1956	Hildenbrand	Meier	C	
919		919	G-2	1962	Rodger	Benante, Lehn, Sims	B	3
919	A	919	Cyrogenic	1964	Hildenbrand	Meier	B	3
919	B	919	Beam Component	1966	Lehn	Rodger	B	3
919	C	919		1967	Hildenbrand	Meier	B	3
919	G	919		1967	Hildenbrand	Meier	B	3
919	X	919	Beam3/Beam4		Sims		B	3
921		919	Rectifier House	1963	Hubbard	Skelton	B	3
949		919	G-2 Tunnel/V Target		Sims		B	4
975		919	North	1968	Lehn	Sims	B	4
975		919	South	1968	Gill	Sims	B	4
927		927	Neutrino Tunnel	1971	Sims	Phillips	A	3
927	A	927	Neutrino Pump House	1971	Dale	deBoer	A	3
927	X	927	Neutrino PS House	1971	Sims	Stillman	A	3
927	X	927	Concrete West Side Uline		Pendzick	Sims	A	3
965		927	Neutrino E734	1981	Pearson	Pendzick	B	5
967		912	Beam Analysis E787				C	2
930		930	200 Mev LINAC	1969	Hensel	LoDestro	A	4
930	A	930	Annex - Ion Source		Hensel	LoDestro	A	4
930	Annex	930	Booster PS		Hensel	LoDestro	B	4
930	Ext	930	BLIP/HEBT/Medical/Cliff		Hensel	LoDestro	A	4
946		930	LINAC Beam Stop House	1988	Dale	deBoer	A	4
0			SREL Magnet		Pendzick		C	
915			Well 101	1958	Dale	deBoer	C	5
916			Well 102	1958	Dale	deBoer	C	5
917			Well 103	1958	Dale	deBoer	C	5
918			Warehouse	1958	Downing	Advent	C	5
936			Storage	1980	E. Schwaner		C	N/A

Appendix B

AGS Release Points Committee Members:

L. Ahrens	ahrens@bnldag.bnl.gov	x4568	AGS Division, Assoc. Head	911B
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E. Lessard	lessard@bnl.gov	4250	AGS Department Assoc. Chair for Safety	911B
A. Pendzick	pendzick@bnldag.bnl.gov	4718	Experimental Area Group Engineering Group Leader	911B
J.W. Glenn	Glenn@bnl.gov	4767	Accelerator Physics, Chairperson Accelerator System Safety Review Committee	911C
E. Rodger	Rodger@bnl.gov	4616	Research Engineer (Mechanical)	911B
J. Sandberg	sandberg@bnldag.bnl.gov	4682	AGS Department, Chief Electrical Engineer	911B
W. Sims	sims@bnldag.bnl.gov	3271	Safety and Q.A. Engineering Group Leader	911A
R. Skelton		2540	Retired, former technical supervisor & AGS Dept. Waste Management Coordinator	911A
P. Stillman	pstillman@bnldag.bnl.gov	4659	AGS Department Waste Management Coordinator	911A
J. Tuozzolo, Committee Chairman	tuozzolo@bnldag.bnl.gov	3966	AGS Department, Chief Mechanical Engineer	911B

AGS Department
Potential Environment Release Points
Questionnaire

Active BNL Employee	☐
Retiree	☐

Report No.:_____

Check Appropriate Box: Individual Report ☐ Group Report (Attach Group List) ☐

1. Name(Individual/Group)_____ Life #_____ Ext._____
   Last First M.I.
2. Present Supervisor_____ Present Work Group_____ Mail Stop_____
3. Years Employed @ BNL _____ Signature_____ Date_____

4. I have reviewed items 10 through 25 and can remember nothing which applies to my work. ☐
5. I have review items 10through 25 and wish to report the following information. ☐

Work History:

6. Bldg. #_____ Bldg./Area Name_____ See Attached Map ☐
7. Years Worked: From: _____ To: _____
   Month/Year Month/Year
8. Work Group Name_____ 9. Supervisor(s)_____

In this work area did you or your work group utilize any of the following materials or processes: (Provide details in notes area)	Always	Often	Sometimes	Quantity (if known)
10. Activated Material or sources				
11. Repair or modification of activated equipment				
12. Activated water				
13. Depleted Uranium				
14. Lead				
15. Mercury				
16. Silver plating materials				
17. Other hazardous heavy metals				
18. Machine oil, transformer oil, mineral oils, lubricants, hydraulic fluids, benzene, etc.				
19. PCB Oil				
20. Areas where oil filled power supplies or capacitors were used or stored				
21. Water Treatment Chemicals, Acid and Caustic Soda, etc.				
22. Antifreeze				
23. Cleaning fluids, Vithane, Trichloroethane, Trichloroethylene, Paint Thinners, Toluene, etc.				
24. Other material which could be detrimental to the ground water or air				
25. Are there any instances that you can remember where any of the above materials may have been spilled or disposed of in a manner which may be harmful to the environment?	Yes ☐ No ☐	If yes, describe below.		

26. Notes:

Item #	Describe:

Group 1

Drawings Support
Storm Water System
Sanitary System
Cesspools

AGS Technical Support

Tony Fresco.....Mechanical
Ji Wu Yang.....Mechanical
Hans Vogel.....Chemical, Nuclear, Environmental Compliance

AGS Support

R. Skelton
P. Stillman

Group 2

Priority	Building
A	911
A	912
A	913
A	922
C	940
C	967
	Water Systems Volume

AGS Technical Support Team

Pete Lindahl.....Analytical Chemistry, Environmental Management
Ron Kolpa.....Chemistry, Chemical, RCRA, CERCLA, Site Characteristics
Doug Cole.....Nuclear, Radio Chemistry, Health Physics
Chuck Fellhauer.....Reactor Operations, D&E, Wast Packaging, and Transportation

AGS Support

J. Tuozzolo
A. Carroll
A. Pendzick
R. Hubbard
R. Zaharatos

Group 3

Priority	Building
A	919
B	921
A	927
B	975
C	949

AGS Technical Support Team

Richard Scudero.....Mechanical
Fred Angliss.....Civil/Structural
Bill McConachie.....Chemist, Environmental Restoration

AGS Support

E. Rodger
C. Trabocchi
W. Sims

Group 4

Priority	Building
A	914
A	928
A	929
A	930
B	942
A	946
	Water Systems Volume

AGS Technical Support Team

Udo von Wimmersperg.....Particle Physics, Chemistry
Ji Wu Yang*.....Mechanical

AGS Support

E. Rodger
M. Bannon
V. Lodestro

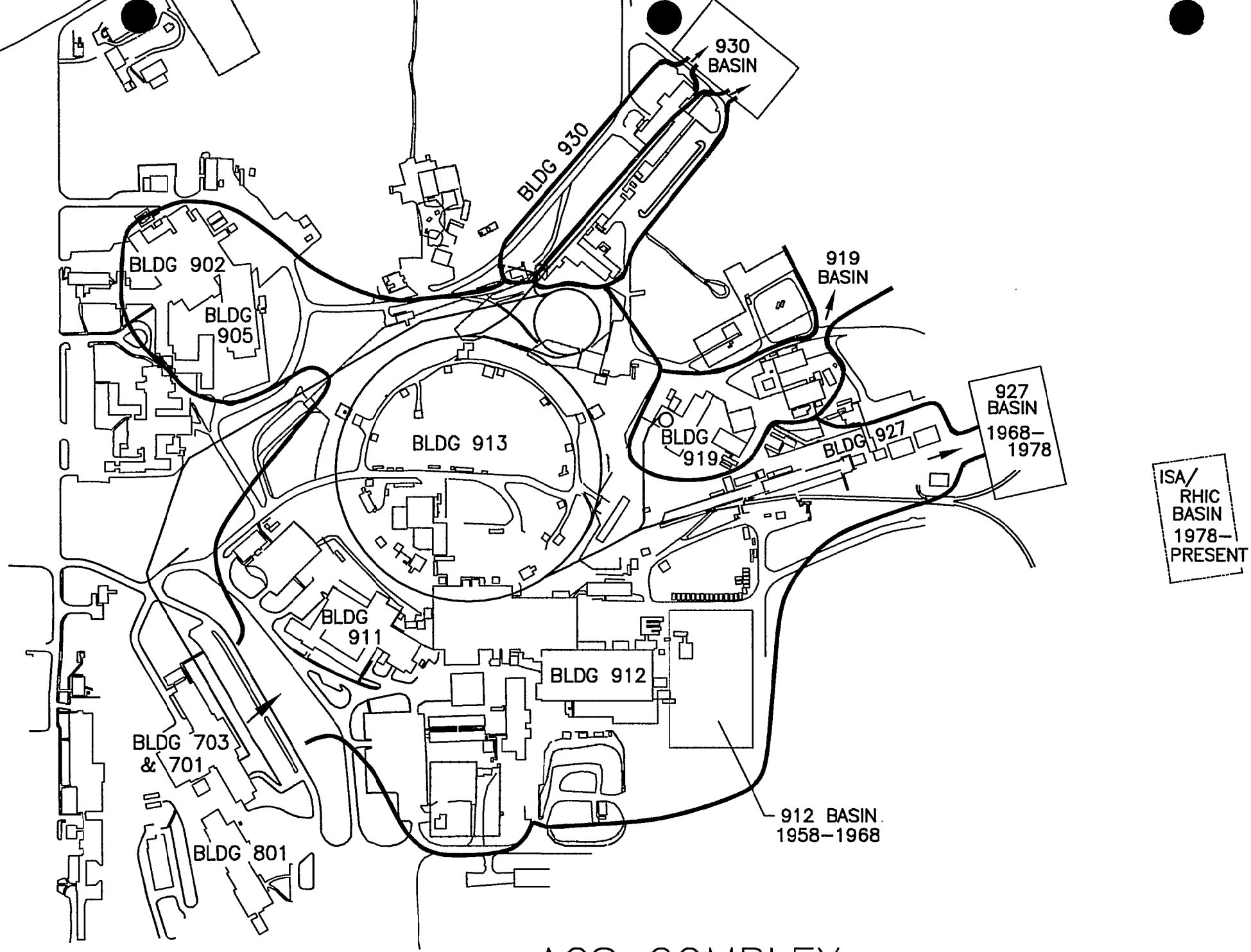
Group 5

Priority	Building	AGS Support
C	209	Ed Schwaner
C	915-917	John deBoer/Ed Dale
B	918	Harold Advent
B	920	Ronald Zapasek
C	923	Bill Sims
B	925	Ralph Sanders
B	932	Ronald Zapasek
B	965	Charlie Pearson
C	966	Al Pendzick

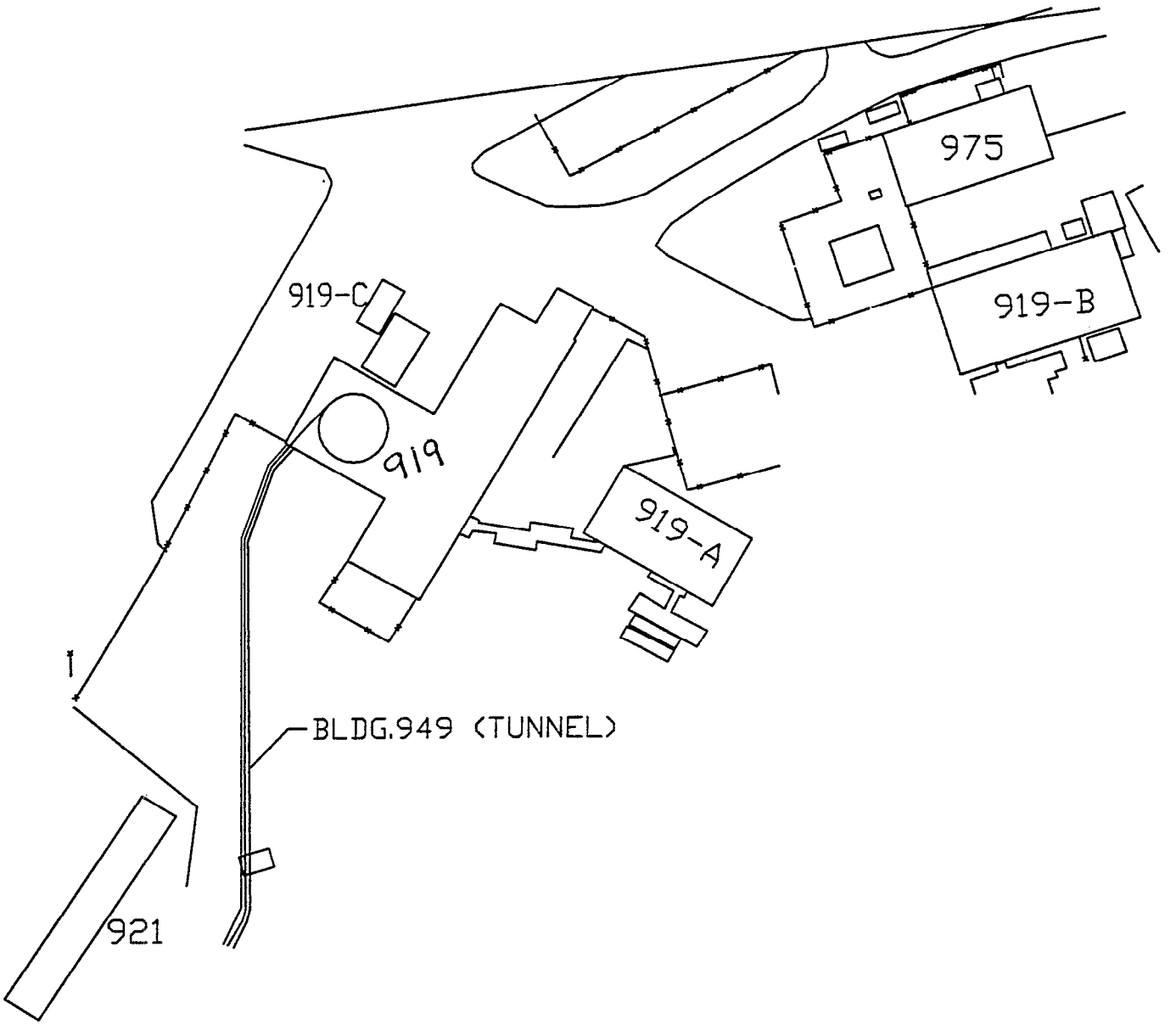
AGS Technical Support Team

Homer R. Yook Team Leader	ORNL, Head, Operations Management Section, Robotics & Process Systems Division
Frank E. Gethers	ORNL, Head, Management, Services Section, Fusion Energy Division
Donald C. Gregory	ORNL, Radiological Controls Section, Office of Radiation Protection

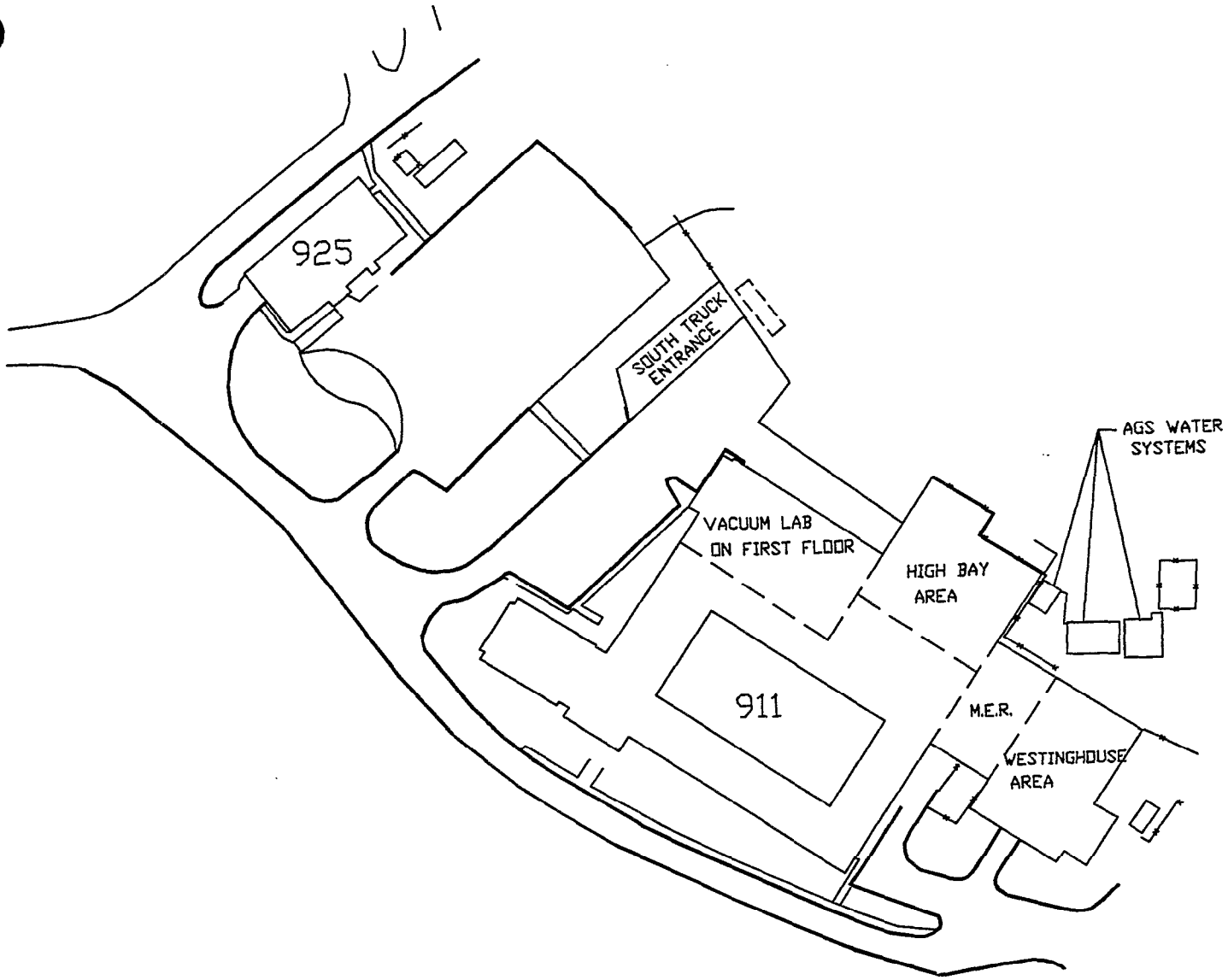
C:\AGS\TUOZZOLO\BREKDWN.SUP


930
BASIN
BLDG 930
BLDG 902
BLDG
905
919
BASIN
927
BASIN
1968–
1978
BLDG 913
BLDG
919
BLDG 927
ISA/
RHIC
BASIN
1978–
PRESENT
BLDG
911
BLDG 912
BLDG 703
&
701
912 BASIN
1958–1968
BLDG 801

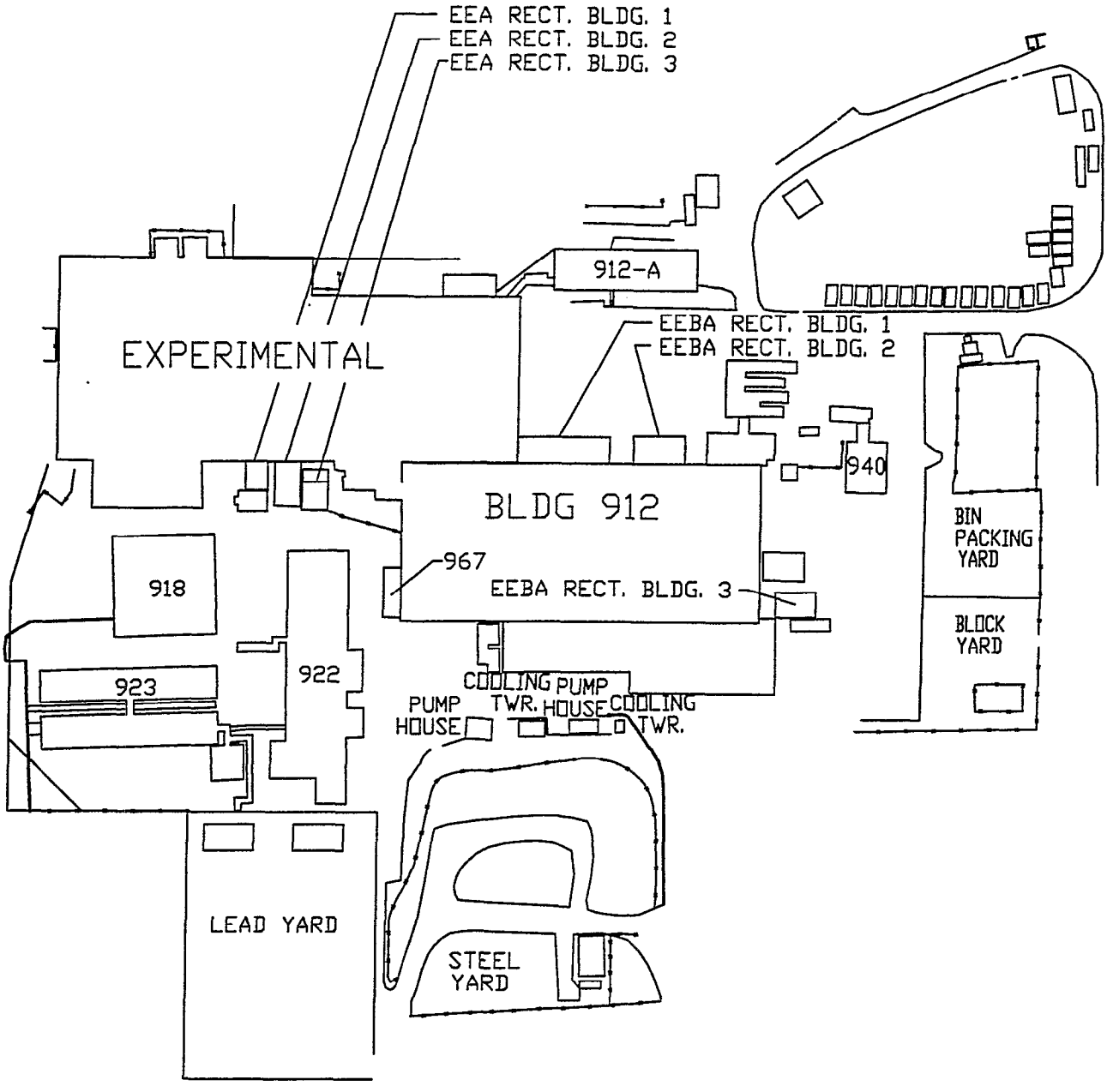
AGS COMPLEX



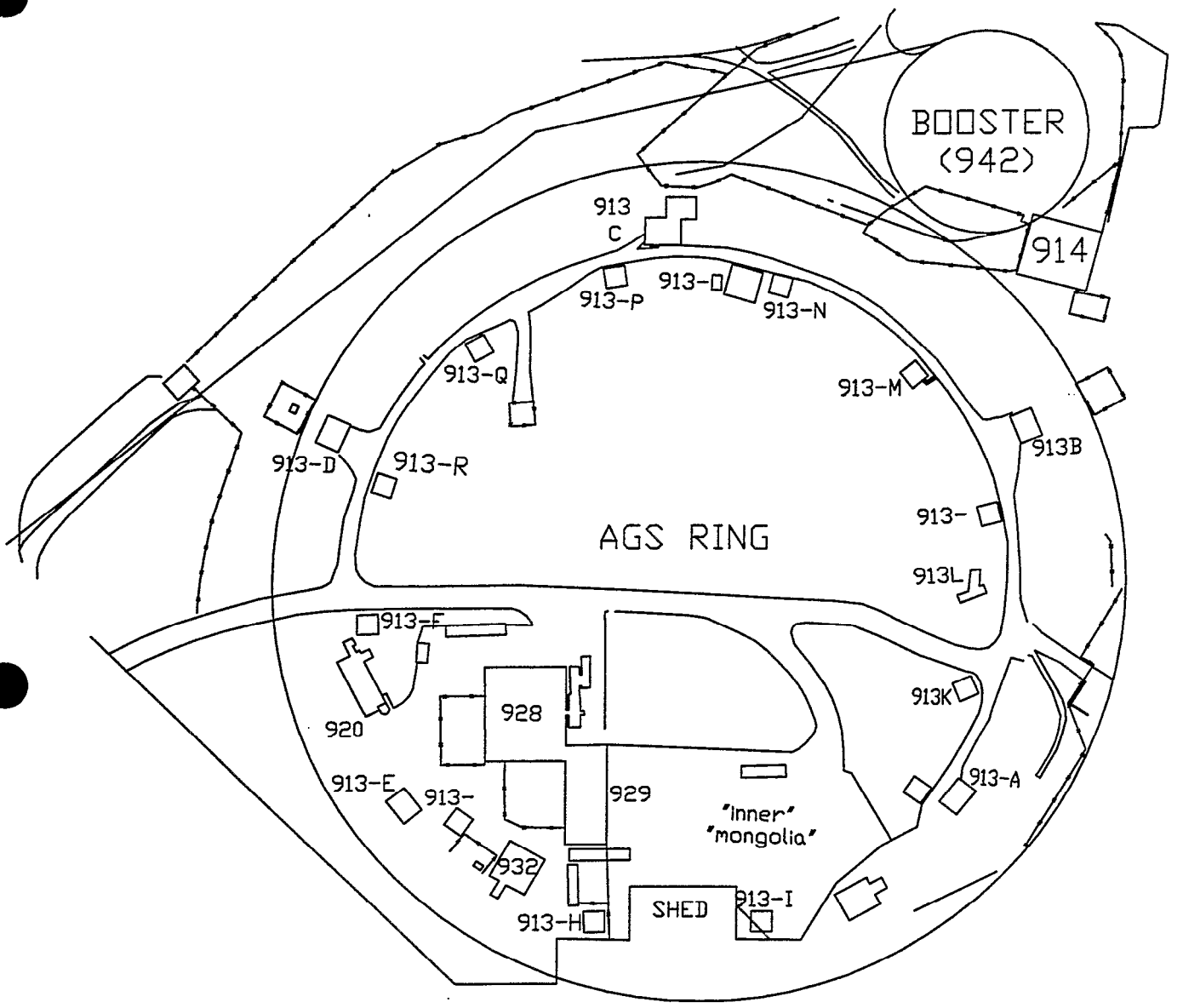
BLDG 919


925
SOUTH TRUCK ENTRANCE
AGS WATER SYSTEMS
VACUUM LAB ON FIRST FLOOR
HIGH BAY AREA
911
M.E.R.
WESTINGHOUSE AREA

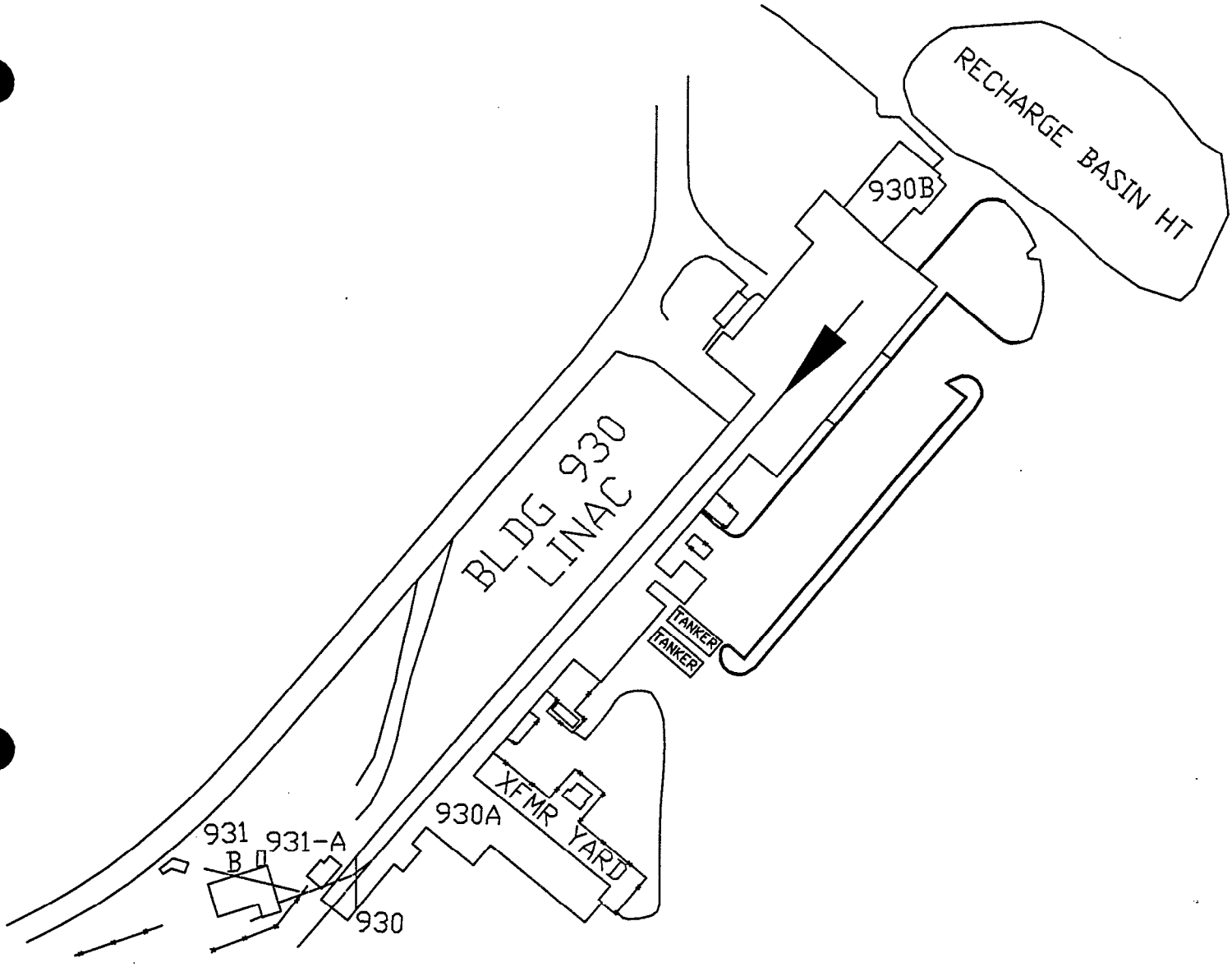
BLDG 911


EEA RECT. BLDG. 1
EEA RECT. BLDG. 2
EEA RECT. BLDG. 3
912-A
EXPERIMENTAL
EEBA RECT. BLDG. 1
EEBA RECT. BLDG. 2
940
BLDG 912
967
EEBA RECT. BLDG. 3
BIN PACKING YARD
BLOCK YARD
918
922
923
COOLING TWR.
PUMP HOUSE
PUMP HOUSE
COOLING TWR.
LEAD YARD
STEEL YARD

BLDG 912


BOOSTER
(942)
914
913
C
913-P
913-O
913-N
913-Q
913-M
913-D
913-R
913B
913-
AGS RING
913L
913-F
920
928
913K
913-E
913-
929
913-A
"Inner"
"mongolia"
932
913-H
SHED
913-I

BLDG 913


RECHARGE BASIN HT
930B
BLDG 930
LINAC
TANKER
TANKER
XFMR YARD
930A
931
B
931-A
930

BLDG. 930

Report #1

AGS Release Points Committee

Report #1 The AGS Linear Accelerator (LINAC) and Associated Facilities:

Facility description:

The LINAC was designed and built in the late 1960's as part of a major upgrade to the AGS facility. When it was built there were two pre-injector areas each 14 m long, 9 m wide and 11 m high. Each pre-injector contained an ion source and a large high voltage pre-accelerator (Cockcroft-Walton). These pre-injectors were replaced in the 1980's by much smaller radio-frequency (RF) quadrupole pre-accelerator and ion sources. The Linear accelerator tunnel is 140 m long and consists of nine large accelerator cavities (each 15 meters long x 1 meter in diameter). From the end of the Linac a 17 meter long spur tunnel injects the beam into the Booster accelerator. Another high energy beam transport (HEBT) line extends 95 meters to connect with the AGS. Since Booster commissioning this line is no longer used for beam transport and is only used occasionally for beam tuning. Another spur tunnel provides beam to the Brookhaven Linac Isotopes Producer (BLIP) facility, the Chemistry Linac Isotopes Facility (CLIF), the Radiation Effects Facility, and the Neutral Beam Test Facility, and a beam stop. Only the BLIP facility is presently used and it has recently undergone a significant upgrade to increase its intensity. The Linac consistently produces a beam of 25 to 35 mA with a 0.5 ms pulse length or 1.0×10^{14} protons/pulse. Pulses are repeated at the rate of 7.5 per second, but at most only 1 in 7 pulses are transported to the Booster with the remainder transported to the BLIP facility.

Four buildings are directly associated with building 930 and three of the four are directly attached. The 930MER provides water cooling services for the Linac complex and contains activated water and industrial water treatment chemicals. Associated with it is a large water cooling tower and a compressor area. The 930 Annex was added in the 1970's and contains shops and storage areas. 930A was added on in the late 1980's as a service building for the Booster project. It contains power supplies and computer control equipment for the Booster. Building 946 houses the water cooling equipment for the BLIP target area. This area was upgraded to provide better containment and shielding for this activated water system.

Facility Buildings:

930	Linac Building (includes linac and its associated power supplies and support equipment). Building 930 also has technical shops, research areas, and storage areas.
930Annex	It is used as a shops and research equipment area.
930A	Power supply building for the Booster
930MER	Mechanical Equipment Room.
946	Water cooling equipment building for HEBT beam stops.

Related Buildings:

The BLIP facility which is administered by the Medical Department.
The REF facility which is administered by the Department of Advanced Technology.
The building 913 complex which accepts beam from the Linac and is the subject of a separate report.

Building Interior Issues:

1. There are activated components in the Linac and HEBT tunnels and spare parts are stored in building 930.
2. Lead is used for shielding in the tunnels and has become activated in some locations. Efforts have been made to remove any lead which is no long being used. A large 3'x3'x2' pile of lead bricks was removed from the BLIP tunnel in 1995.
3. Some of the floor drains in the Linac facility still go to the storm water system and a special storm water recharge basin north of the western end of 930. Some of the floor drains go to a sump in the western end of the building. That sump now discharges to the sanitary system. Previously it discharged to the storm water system. More work must be done in this area to convert the rest of the floor drains in the building.
4. There are no known cesspools associated with this area.
5. The cooling water for the tanks and the HEBT lines is activated and can be lost to the floor drains. There was a recorded incident in 1975 of activated water in the storm drains and the storm water recharge basin. This is believed to be associated with an experiment setup in the BLIP beam tunnel where "once through" water cooling was used on a target and then released to the floor drains. This experiment was removed in that year and that method is not used for target or beam stop cooling.
6. Water systems chemicals have been discharged to the floor drains in the past and have ended up in the recharge basin. Maintenance procedures in this area have been modified so that water is contained during maintenance operations, tested, and disposed of in accordance with Laboratory policy.
7. Oil is used in many different pieces of equipment: high voltage power supplies and transformers, water pumps, and vacuum pumps. A spill of oil could go to the floor drains. An effort is under way to reduce the number of oil filled power supplies. Last year the oil filled supplies for the Linac RF system were converted from an oil filled system to a solid epoxy system to reduce the potential for oil loss.
8. There still are capacitors in the facility which contain PCB's. They are all documented according to EPA notes.
9. Small amounts of mercury are used in the ignitrons for RF power supplies. An effort is underway to dispose of any non-functional ignitrons through a mercury recycling company.
10. Low levels of radioactive contamination contained within the BLIP stub tunnel from air

activation by the beam creating 5/day beryillium - 7. This area is properly posted. The window target area where the activation occurs is being studied. A revised design could reduce the volume of air which has the potential of becoming activated.

11. Building 930 has many shop areas and a small machine shop. Associated with this are the machining fluids, the use of solvents for cleaning, silver plating, etc. As stated previously spills to the floor drains in the 1970's and 1980's went to the storm water system.

Building Exterior Issues:

1. The recharge basin north of the western end of the building as stated in section 1 above has taken discharges from the building floor drains. There have been numerous studies of this basin by S&EP.
2. Vacuum pumps for one laboratory facility were located outside of the buildings. About 1 to three gallons of oil from the pumps did leak out and spill on to the ground on one occasion. This incident was reported and remediated. The pumps are no longer outside.
3. Oil filled transformers.

Documents Reviewed:

1. Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, New York Environmental Assessment, U.S. Department of Energy, DOE/EA #0909, March 1994
2. AGS Booster Final Safety Analysis, AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton NY, February, 1991
3. Report of the Investigation Committee on the Fire in the Cascade Voltage Generator in Pre-injector No.1, Bldg.930 at Brookhaven National Laboratory, Upton, N.Y. October 27, 1984
4. "Unusual Occurrence Report" UOR 89-29
5. Alternating Gradient Synchrotron Department, Profile of Programs in: Environment, Safety and Health; Quality Assurance; and Conduct of Operations, December 1996
6. Integrated Safety Management Evaluation of the Brookhaven National laboratory, DOE Office of Environment, Safety and Health, April 1997
7. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National laboratory, December 1996
8. State Pollutant Discharge Elimination System (SPDES) Discharge Permit, Special Conditions (Part I) (SPDES # NY-0005835), New York State Department of Environmental Conservation, Issued 03/01/95
9. Air and Water Emissions Maps and Permits for Brookhaven National Laboratory, Internally derived index, No date
10. Characterization of Low level Radioactive Waste From the AGS Complex Including An Assessment of Pure Beta (ß) Emitters, E. Lessard, 11/1/95

Drawings Reviewed:

1. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
2. D02-M-493
3. D21-M-3,6,007,009,010
4. D21-M-2484-402-M1 to M4,M10-A,M10-B,M11 to M25.
5. Sanitary System map, No. 64, 1992
6. Storm Drainage map, No. 64, 1992
7. Sewerage-Drainage map, No. 45, 1989
8. Sewerage-Drainage map, No. 44, 1989
9. Water and Gas map, No. 45, 1989
10. Water and Gas Map, No. 44, 1989

AGS Release Points Committee

PERP Report #2 The AGS Accelerator Rings and Associated Facilities:
AGS Ring, Booster Ring, Support Power Supply Building, Support Shop Areas, Outside Storage Yards, Mechanical Equipment Facilities, Southwest Experimental Area.

Facility description:

The AGS tunnel has a circumference of 800 meters and is buried under a 7 meter thick berm of earth and concrete. In this tunnel there are 240 large alternating gradient dipole electromagnets and over one hundred supporting focus and beam tuning magnets. Also in the tunnel are RF accelerating components, vacuum systems, water cooling systems, etc. The AGS tunnel is designated as building 913. Supporting the tunnel operation are the ventilation system fan houses and multiple power supply houses. Some of these are designated 913A through R, others have a separate plant engineering building number. The AGS tunnel (building 913) is interrupted at the Experimental Hall, Building 912, for roughly 65 meters. Here the AGS is under heavy concrete shielding blocks. Building 912 is covered separated by PERP Report #3.

The Booster tunnel is directly adjacent to the AGS tunnel and the LINAC. It is connected to the LINAC and the Tandem Van de Graaf via the HEBT transfer tunnel described in PERP Report #1. The Booster uses as part of its tunnel building 914 which served as the original AGS direct injecting LINAC when it was built in 1960. The original connecting tunnel is now used to transfer beam from the Booster to the AGS. The Booster tunnel is 200 meters in circumference and is buried under a 5 meter thick berm. The new section of the Booster tunnel designated building 942 was built in 1988.

Related Facility Buildings:

913A-E	AGS ventilation system fan houses.
913C	(A10 house) Also contains power supplies.
913F-R	(The 18 houses) Contain power supplies for equipment in the AGS tunnel.
913	(H-10) Houses various small power supplies for equipment in the AGS tunnel.
920	(E-10) Houses various small power supplies for equipment in the AGS tunnel.
928	Houses the power supply (Siemens motor generator set) for the 240 large alternating gradient magnets along with associated transformer yards, lubricating equipment rooms, and water cooling systems.
929	Houses the RF accelerating system power supplies and the associated transformer yards. Historically it has functioned as a power supply building.
932	(F-10) Houses power supplies for special ejection magnets in the AGS tunnel.

Related Buildings:

Building 911 The AGS main office building houses water cooling systems, the original main magnet power supply (now the back-up supply), the control room, offices, and technician shops which support the AGS operation. This building is covered

separately in PERP #4.

Building 912 The AGS experimental floor which also contains a section of the AGS ring.

Interior issues AGS and Booster Rings Buildings 913, 914, & 942 Issues:

1. There are activated components in the AGS and Booster rings and activated spare parts are stored in the facility.
2. Lead has been used as shielding in the facility.
3. Floor drains for the AGS ring go to a system of sumps around the ring. These now act as secondary containment for any spills in the AGS. Before 1990 if the sumps became filled with water they were automatically pumped out to cesspools which were buried in the AGS berms. The sumps have been converted so that the pumps now transfer the water to the sanitary system. At the present time even that system is not used in the AGS tunnel. Water is pumped out of the sumps into a transport tank where it is held until the water is tested. After it is tested the water is disposed of in accordance with laboratory policy. As a pre-caution the sumps will be lined to prevent leakage.
4. In the 912 area of the AGS ring there are floor drains but there were also open pile caps with a direct pathway to the soil under the tunnel. A release of water in the early 1990's brought attention to this area. A program of sealing the pile caps to prevent this pathway was completed by 1994.
5. In the Booster, the floor drains go to the sanitary system where the water can be monitored and held if necessary.
6. In the Booster building 942 water goes to a sump in the basement and from there it is pumped to the sanitary system. Before the booster project the water was pumped to the storm water system.
7. All of the cooling water systems in the AGS and Booster tunnels are activated. This includes systems which use the AGS ring as a utility tunnel for piping which goes to the support buildings. The water systems also contain water treatment chemicals.
8. Domestic water is routed through the AGS ring. This system has been shut down.
9. A bathroom facility is located in the AGS ring which will be removed.

Interior issues 913A-E AGS ventilation system fan houses:

The fan houses were an original part of the AGS ring and provide air-conditioning and heating for the tunnel enclosure. Because of their proximity to the tunnel they are High Radiation Areas when there is beam in the AGS ring and must be kept secured during operations. The cooling water for the air-conditioning system is routed through the AGS ring. It is activated and there is a potential for release in the fan house. Air handled in the fan houses is from the AGS tunnel air and can also be activated.

Other issues:

1. The floor drains in all of the fan houses are french drains which can discharge a release to the soil under the building or the adjacent roadway.
2. Condensate catch pans and lines associated with the cold air returns lead to exterior asphalt.

3. Fan motors contain oil which can leak to the french drains.

Building 914 issues:

As stated previously building 914 was the location for the original 50 Mev AGS Linac. This facility contained power supplies, water cooling systems, pumps and compressors, and a motor generator set. During the 1970's and 1980's, after the Linac was decommissioned, this building housed a mechanical maintenance group for the AGS division. Activated components were repaired and stored in this facility and new components were assembled and cleaned there. Associated with these activities are the use of solvents, mild acids for cleaning, and lubricating oil for vacuum pumps. The floor drains for this building went to the storm water system throughout this time so any releases went to the storm basin. This building was serviced by a cesspool which was tested and removed in 1993. Only trace contaminates were found.

1. There is also an old metal sided shed off building 914 which held a diesel motor generator in the 1960's. The generator was removed in the early 1970's and there is no evidence of a fuel tank. This shed has a french drain.
2. A second Metal shed houses a compressor room with its associated lubricating oil. There have not been any documented spills but the disposition of the floor drain will be investigated. This compressor room now serves the Booster.
3. Oil was used in a large power supply associated with Linac operations. This supply was removed in the early 1970's. There is no record of there ever being a problem.
4. There were probably capacitors in the facility which use PCB's. They were removed in the 1970's.
5. When the linac water systems were flushed the water and its water treatment chemicals were released to the floor drains or the cesspool. No documentation of these procedures presently exist.
6. Mercury diffusion pumps were used on the pre-accelerator section of the Linac. There was no memory or documentation of a spill from these pumps.

Building 920 (E-10 house) issues:

Building 920 is the E10 Power Supply building, and is located above the AGS ring. It uses metal frame and siding construction, and was built in about 1971 for its present use. It houses an assortment of power supplies used under different beam configurations, but is presently running only a few supplies. Additional power supply systems once in the building have been removed, and other systems are available but unused for the present configuration. The hazards in Building 920 are high voltage, radiation from activated cooling water, and oil in transformers. There are no floor drains, sinks, or bathroom facilities in the building. A spill would be contained on the floor unless it was large enough to flow outside of the building to the surrounding soil.

Other issues:

1. Cooling water for the power supplies is currently supplied from the Fast Pulse Quad Cooling Water System via a nearby building, and orange rubber hose is used to connect the power supply to the water which enters at the north side of Building 920. This water is piped

through the AGS tunnel and it is activated.
2. Cooling water for power supplies in the building was supplied directly from the AGS Main Magnet Cooling Water System, and there is also a booster system (housed in a shed attached to the building) which has in the past also been connected to that water system. Presently both of these systems are unused and are not under pressure. This cooling water is activated.
3. Two oil-filled transformers are being stored in the building. Both have "NO PCB" labels, and the total amount of oil in the two transformers is estimated to be somewhere between 50 and 100 gallons. Secondary containment is not required for these transformers because of their small size. Whether they are still needed in the building is an action item.
4. No Unusual Occurrence Reports were found for Building 920.

Buildings 928 (Siemens motor generator house) and 929 (RF Power Supplies) Issues:

This steel framed metal sided building houses the present AGS main ring magnet power supply motor generator set. LILCO AC power runs the motor, which turns a DC generator, which provides current for the AGS dipole magnets. Associated with this operation are transformers and power supplies, motor control equipment and switch gear, cooling systems, and lubricating oil systems. The motor generator set is currently being upgraded in a staged program. Four years ago mercury filled ignitrons tubes were removed and replaced with units without mercury. The mercury was sent to a commercial recycler. The transformer yards are in the midst of an upgrade which will provide adequate containment in the event of a spill. The floor drains in the building which previously to the storm water system have been converted to the sanitary system.

Building 928 is directly adjacent to and at one corner connected to building 929. Both buildings share a common basement area. The basement area contains support electrical equipment and lubricating equipment for the motor generator set. Also in the basement is a mechanical equipment room with water cooling equipment for power supplies in 928 and 929 and for systems in the AGS ring. Associated with this are the typical industrial water cooling chemicals and some activated water.

Building 928 contains power supplies for equipment in the ring including the RF system.

Other issues:
1. A major oil spill occurred in this building releasing ~150 gallons of oil and ~90 gallons of TCA to the floor drains. From there, the spill went to the storm water discharge basin at the end of the U-line. This spill was not reported or remediated at the time.
2. Aqueous sodium carbonate was released to the floor drains in the past during maintenance activities. This no longer occurs.
3. The power supplies in building 929 use the same activated cooling water system which is used for components in the ring. Care must be taken when leaks occur. At the present time the floor drains go to the sanitary system.
4. There are power supplies in the building with PCB capacitors.

Building 932 (F-10 house) Issues:

Building 932 (also called the F10 Power Supply) is a metal frame and siding building on a concrete slab. The original construction included only the back half of the building. No drawings were found for the original construction but photographs date its construction between 1964 and 1967. Building 932 was doubled in size by an addition constructed in 1971. The building houses special power supplies for the AGS ring. A small room directly against the AGS shielding berm houses the electrical bus which travels down to the ring via an enclosed sleeve. This room is a high radiation area when the AGS is in operation. A self-contained water cooling system is directly adjacent to the building. The water not only cools the power supplies in the building but it also cools the electrical bus which goes down into the tunnel. Because of this the water has low levels of activation. The water system also uses standard industrial water treatment chemicals. The floor drains in the building drain directly to the soil underneath the building or into the storm water system. There are no known incidents of releases from this building though it is likely that maintenance of the water cooling system in the 1970's and 1980's may have resulted in a release to the floor drains.

AGS Ring Exterior Issues:

The asphalt pad on the inside of the AGS ring adjacent to building 912 (nicknamed "Inner Mongolia") has been used for many different purposes over the years. It was an experimental area in the 1960's with two secondary beam lines (beam1/beam2). Associated with this are the power supplies and hydraulic equipment which are used with bubble chamber detectors. No documentation of leaks in the area was located but there is a memory of leaks. Any leaks would have gone to the storm water system via storm drains in the area. Since that time power supply buildings were located in the area, activated components have been stored and repaired in the area, a transformer yard is located there, and transformers have been stored there. The area is still serviced by storm drains which go to the storm water system.

Cesspools which service the AGS ring are buried beneath the shielding berm. As noted in the 913 AGS ring section, the cesspool no longer receive effluent from the ring. It is not clear that all of the cesspool locations have been identified and located.

The southwest experimental area, which has not been used for more than twenty years, had an experimental trailer complex with bathroom facilities. It is believed that the facilities were port-o-potties. There is no documentation for the location of any cesspools which may have serviced that facility. Also the existence and location of storm drains in the area is unknown. Environmental hazards associated with that area would be oil in power supplies and lubricating oil in pumping systems. The entire area is now buried under the shielding for the Tandem Van de Graaf beam transfer line.

There are many outdoor transformers which provide power for the complex. These are covered by the transformer report.

Documents Reviewed:

1. Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, New York Environmental Assessment, U.S. Department of Energy, DOE/EA #0909, March 1994
2. AGS Booster Final Safety Analysis, AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton NY, February, 1991
3. Evidence of payment under contract for disposal of BNL solid wastes at the Town of Brookhaven Sanitary Landfill for the period 12/13/83 to 05/09/97, Fax from M Zane to R. Skelton, May 9, 1997
4. Alternating Gradient Synchrotron Department, Profile of Programs in: Environment, Safety and Health; Quality Assurance; and Conduct of Operations, December 1996
5. Integrated Safety Management Evaluation of the Brookhaven National laboratory, DOE Office of Environment, Safety and Health, April 1997
6. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National laboratory, December 1996
7. State Pollutant Discharge Elimination System (SPDES) Discharge Permit, Special Conditions (Part I) (SPDES # NY-0005835), New York State Department of Environmental Conservation, Issued 03/01/95
8. Air and Water Emissions Maps and Permits for Brookhaven National Laboratory, Internally derived index, No date
9. Characterization of Low level Radioactive Waste From the AGS Complex Including An Assessment of Pure Beta (ß) Emitters, E. Lessard, 11/1/95
10. Radiation Protection Studies During High Intensity Running at AGS, Radiation Exposure Around the AGS Ring and in the SEB Experimental Areas, Accelerator Division Technical Note, E. Lessard *et. al.*, March 14, 1995
11. Occurrence Report (Final Report), CH-BH-AGS-1995-0004, Alternating Gradient Synchrotron, Low Level Radioactive Material in Recharge Basin Where Not Expected, 03/04/1996
12. Memo E. Dale to R. Miltenberger cataloguing AGS Water Sytems, February 7, 1990

Drawings/Maps Reviewed:

1. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
2. Drawing Set, Floor Drain Modifications, Project 7610, Lockwood, Kestler and Bartlett, Inc., June 1994
3. Sanitary System map, No. 64, 1992
4. Storm Drainage map, No. 64, 1992
5. Sewerage-Drainage map, No. 45, 1989
6. Sewerage-Drainage map, No. 44, 1989
7. Water and Gas map, No. 45, 1989
8. Water and Gas Map, No. 44, 1989
9. 9212.05-FB-1A building 914

10. 2484-410-C3; 2484-410M1,M2,M4 Building 928
11. 2484-410-C3; 2484- 408-M1,M2,M4; 7903-Cl,P1. Building 929
12. DO2-456-3 Building 942

AGS Release Points Committee

PERP Report #3 - The AGS Slow Extracted Beam Line Experimental Floor: Building 912 and Associated Offices, Control Room, Shops, Mechanical Equipment Facilities, Power Supply Areas, Warehouses and Storage Areas.

Facility description:

Building 912 is the designation of the approximately 5 indoor acres of AGS experimental floor. It is not one building, but 5 connected structures constructed over a 30 year period. Within this large area, a majority of the ~400 AGS experiments have been located. The equipment in the main building includes the beam lines with magnets, instrumentation, high voltage electrostatic devices, beam targets, radiation shielding, cooling water, and experimental detectors. Also located in 912 and its support buildings are power supplies, computer equipment and offices for experimenters, support shops, mechanical equipment areas with water cooling and backup diesel generators, indoor and outdoor storage areas, temporary buildings, and trailers.

A typical beam line contains bending and focusing electro-magnets along with their associated electrical power supplies and cooling water systems, and vacuum pipes. Beam lines in which particles of different masses are selected use parallel plate electrostatic separators operating at several hundred kilovolts. Surrounding the beam lines are concrete and steel shielding needed to maintain radiation levels outside the lines to within the required limits. Shielding around the proton target stations which produce secondary beams is much thicker due to the high levels of radiation generated in the targets. This shielding can have significant activation contained within the body of the material. Cooling water at these target stations has higher levels of activation than the magnet cooling water and is handled by closed cooling systems. Radiation safety is provided by security systems which absolutely prevent access to these target stations and primary beam lines when protons are being extracted to these areas. Radiation detection devices, "Chipmunks", record the lower radiation levels outside the shielding.

Experiments are located at the end of the secondary beam lines for periods of one to 10 years. The detecting elements in Bldg 912 generally include magnets with copper or super-conducting coils, scintillation counters with photo-multiplier tubes, wire chambers with mixtures of argon and organic gases, and cryogenic targets containing hydrogen or helium. These devices are thoroughly reviewed for personnel and environmental safety before they are operated.

Just outside Building 912 and frequently connected to it are a number of auxiliary structures. These contain power supplies, cooling water pumps, and shops and offices. Most of the experimental control rooms are contained in trailers or prefabricated structures. The use of these structures provides valuable space in the experimental halls, and reduces the possible radiation burden on the people in the area.

Facility History:

The initial portion of Building 912 was started in 1958 to enclose both a portion of the AGS ring and the first experiments. The particle beams for these experiments, including the world's first detection of accelerator produced neutrinos, were derived from targets internal to the vacuum chamber of the AGS ring.

The East Experimental Area(EEA) was begun in 1960 to accommodate the expanding experimental program. In this area a variety of beams were developed in the early 1960's using particles from internal targets, and by the late 1960's, experiments were developed to use the full energy and intensity of beams extracted from the AGS ring.

With the higher intensities generated from the AGS improvement programs, internal targets were no longer a viable option because of the increased activation of the accelerator components. In 1970 a new addition comparable to the size of the original halls was built to accommodate the expanding number of target stations accepting the extracted proton beams. This was the East Experimental Building Addition(EEBA). By the beginning of the 1980's
the general pattern of proton beam lines to target stations was established in Building 912 except for the D line which added in the mid 1980's. In 1981 and 1986 two smaller additions were added to EEBA to accommodate a new separated secondary beam and a beam for heavy ion experiments.

Other Facility Buildings:

912A	Mechanical Equipment Room and Diesel generator room.
922	Equipment Repair and Maintenance Shop.
923	Electronic Equipment Repair and Maintenance Shop.
940	Computer
966	Beam Analysis E935
967	Beam Analysis E787

EEA Rectifier houses #1, 2, 3 and EEBA Rectifier houses #1&2&3.
Experimental Control Room Trailers
Trades Trailers
Equipment Storage Yards - Steel, Shielding Block, Lead, Wire and Cable Tray, Material Sorting Areas and Experiment Equipment Storage Sheds SN 1-26 (NW of EBA).

Related Buildings covered by separate reports:

Building 913, the AGS ring which is connected via a main entrance (south gate) way and via underground tunnels (south wiring tunnel).
Building 912, directly adjacent to 911 connected via underground passageway and tunnels.
Building 918, Area warehouse

Building 912 Issues:

1. There are activated components in the beam lines including highly activated targets. Access to these areas is carefully controlled and when the materials are no longer needed they are disposed of in accordance with Laboratory policy.
2. The target areas result in high activation in adjacent equipment including the floors and the ground underneath. The present targets include shielding which significantly reduces ground activation and in the early years before the shielding was used, the AGS intensity was much lower.
3. Many of the floor drains in the 912 originally went to the storm water system. In the 1990's a program was begun to convert floor drains from the storm system to the sanitary system. All of building 912 is on the sanitary system.
4. The water systems for magnet and target cooling are activated by the beam. Small spills can and have gone to the floor drains which prior to their conversion went to the storm water system before the change in routing.
5. Steel cutting including activated shielding steel has been performed both inside and outside of building 912. The areas are cleaned up after cutting and contamination samples have been taken. Further testing of the soil outside and a storm drain at the door to this area will be performed.
6. Oil is used in many different pieces of equipment: high voltage power supplies and transformers, lubrication of the motor generator, water pumps, and vacuum pumps. There are no problems at this time and little indication of past problems.
7. There are still capacitors in the facility which use PCB's. They are all documented. Any spills in the past have been documented and properly remediated.
8. Lead is used as a shielding material in the facility.
9. Depleted Uranium was used in experimental areas in the past, but; its use and disposition was tightly controlled.
10. Small radioactive sources (nCi) are used. They are inventoried and stored in locked shielding boxes.
11. Various gases and vaporized liquids are used in particle detectors including: hydrogen, helium, CO_2, ethane, isobutane, krypton, methane, argon, and freon. These are known releases registered with S&EP.

Building 912A Issues:

Building 912A is a major support building for the AGS facility. It houses four diesel generator sets which provide emergency electrical power for the facility, water cooling equipment for the experimental floor in 912, and compressors. Both the diesels and the water equipment have associated environmental problems of oil storage and use, a diesel fuel tank, lead acid storage batteries, water treatment chemicals, and activated water.

Specific Issues of note are:
There is a 3000 gallon buried diesel fuel tank which supplies the generators and is listed with

SCDHS (#206). The original tank was removed and replaced in 1985.
The building floor drain were routed to the sanitary sewer system in 1994. Prior to that any releases from the building would have gone to the storm water system.
Two cesspools have been identified adjacent to this building which are not on the BNL site sanitary drawing. There is a sink in the building. Where it drains is not shown on the drawings.

Building 922 Issues:

Building 922 is the major technical support area for experimental support equipment. It was built in 1963 and has been in continuous use as an AGS shop area since that time. It has been expanded twice in the past twenty years. It is one level, with a main floor divided into two main areas, one for general metal work and the other used of electromechanical support of the AGS. This building had three pathways for potential environmental releases. The floor drains went to the storm water system. Sinks went to cesspools which serviced the building. There was a recharge basin north of the building which accepted water from the test magnet cooling system and possibly from some of the sinks in the building. This building was included in the Project 7610 modifications that transferred the sewer effluent from two main septic tanks located immediately north of the main roll up door, to the sanitary sewer. The cesspools have been tested and removed. The floor drains have been rerouted from the storm water system to the sanitary system.

The specific issues of note are:

1. Work in the shop includes welding of activated steel plate used on magnets or for shielding applications.
2. Use of solvents for cleaning of surfaces is prevalent. Paints, epoxies, and resins are also used and stored in the facility. Mild acid baths (AC500 and Wedac) and silver plating operations are also performed in the facility. Prior to the late 1980's the disposal of these fluids was not closely regulated. Some of it was dumped in the sinks and floor drains. Presently these materials are controlled and tested before they are disposed of in accordance with laboratory policy.
3. Though the cesspools have been tested and removed no documentation exists on testing the soil in and under the building recharge basin. Some remediation did occur there as a result of a specific spill of antifreeze but more may be necessary.
4. Vacuum pumps and power supplies require oil which is also stored and used in the building. The power supplies sometimes contained PCB's. There is no known incident of spills of oils or PCB's. They were always disposed of in accordance with Laboratory policy.
5. Magnets are assembled and tested in this building so there is a closed cooling system which is used for that purpose. As mentioned in item 3 above, a spill in this system can release water system chemicals to the soil. Further study of this system is required.

Building 923 Issues:

Building 923 consists of two wings connected by a single cross-corridor, with a small addition

(the "Empire Room") attached to the northeast corner of the building. It was originally constructed as an office building in 1963 or 1964 and has been modified at least twice. Currently, the west wing is occupied by the AGS survey group and an instrument calibration facility, and the east wing houses the High Energy Equipment Pool (mostly electronic equipment storage and repair). The primary hazards in the building are some low-contaminated or activated materials, two calibration sources, and standard chemicals. The west wing contains a machine shop which is used for small jobs. The machining involves minimal amounts of cutting oil, and the operation poses no significant environmental threat.

There are no floor drains in Building 923. There are four catch basins (two on each side of the connecting corridor) between the two wings which seem to be storm drains. Existing storm drain drawings do not show all four basins, nor do the connections between basins seem to agree with existing drawings. The west wing contains two sinks (located in different rooms). The sink in the Laser Optics Survey Lab does not have any documented connection to the sanitary sewer system. The sinks are labeled "Not for disposal of toxic, radioactive, or hazardous materials - water only." The east wing has two bathrooms and a janitor's closet which drain into the sanitary sewer system through a sump basin located in the northeast corner of the building. Outside the west side of the building, three white plastic pipes leading into the ground indicate an old drainage system. Whether it leads to a drywell or cesspool is not apparent and the pipes do not appear on the building drawings. The only obvious connection point to the building has been sealed off.

Other Specific issues of note are:

1. The calibration shop at the back of the west wing contains two significant sealed sources which are normally shielded. The area is locked when the sources are exposed.
2. There is a chemical storage refrigerator next to one of these two sinks. The refrigerator is fairly recent, and presently contains only dry cell batteries. There is no indication that any other hazardous items have been stored in the refrigerator.
3. A sink and washing machine are located in adjacent rooms toward the front of the east wing. The washing machine is used to clean electronic equipment and the drains lead to the sanitary sewer system. In 1995, when potentially contaminated electronic equipment was washed, the water was caught in a barrel for held and tested before disposal in accordance with laboratory policy. Only water and standard consumer soap are used in the washing machine. Occupants of the building believe that the sinks drain to the sanitary system though it is not clearly indicated on the building drawings.
4. The "Empire Room," which is attached to the northeast corner of the building, is only used for limited storage at this time, and there is no evidence that any hazardous operations were ever carried out there though mercury vapor vacuum tubes are stored there. An effort is underway to determine if the tubes are needed.
5. The Historical Site Review report cites the presence of a gas tank "between the warehouse and assembly building." There was no indication of a gas tank in the other documents reviewed. Visual inspection of the location between the north end of the "Riggers Trailer"

and Building 922 showed no indications that there is presently a gas tank in that area (no visible standpipes or fill lines, and a storm drain line now runs through that location).

6. Drawings indicate that the original floor tiles were vinyl-asbestos.

Building 940 Issues:

Building 940 was constructed during 1980 and was initially used as a main frame computer facility. With the advent of PC's, the facility is currently used as a PC staging area and as office space for experimenters. The building contains an active Halon fire suppression system. The building was initially serviced by a cesspool. In the early 1990's this building was included in the Project 7610 modifications that transferred the sewer effluent from a septic tank to the site sanitary sewer system. There were traces organic solvents found in the septic tank which indicated that it may predate building 940. Documentation on the cesspool and when it was built could not be found.

Building 966 and 967 Issues:

Both Buildings 966 and 967 were originally constructed about 1987 as electronics and counting houses for AGS experiments. Their use and function have not changed since they were built. Equipment in the building is predominantly computers and electronics. Both buildings are metal sided prefabricated structures (Parkline, Inc.). Building 966 rests on a concrete slab and is supported by a concrete block wall about 2 feet high. The concrete block wall provides space for the raised floor under which wire and cables are run for the computers and other electronics in the building. Building 967 is a raised structure located above the beam line in building 912. There are no floor drains or other notable hazards in either buildings.

EEA Rectifier houses #1, 2, 3 and EEBA Rectifier houses #1&2 Issues:

The rectifier houses are metal sided prefabricated building built on concrete slabs. Only the EEBA rectifier house #2 has floor drains and they lead to the storm sewer system. The EEA houses were built and occupied in the early 1970's as part of the switchyard upgrade and the EEBA were built and occupied in the early 1980's with the EEBA extension. The buildings house power supplies for equipment in 912. Some of those buildings contain PCB capacitors which are documented and logged. Only one spill of PCB's has occurred (~2 oz.) and it was documented and remediated when it occurred.

Experimental Control Room Trailers A through K:

These trailers arc mainly office space and computer equipment rooms. Some light electrical or mechanical work may also be performed in these spaces. At worst they may contain small quantities of cleaning solvents such as alcohol and acetone.

Trades Trailer Area:

The trades trailers are located between building 918 and building 922. They are mostly office space, a lunch/break area with sink, and storage space for equipment. The most notorious trailer was used for paint storage. It was removed in 1994 because the paints were being improperly stored inside. The only open issue is the sink in the lunch break area. It apparently drains into an undocumented cesspool which services the 918 warehouse.

Equipment Storage Yards - Steel, Shielding Block, Lead, Wire and Cable Tray, Material Sorting Areas and Experiment Equipment Storage Sheds SN 1-26 (NW of EBA).

These storage yards form an L around the north and east end of building 912. They are used mainly for shielding storage though other equipment is stored as well. Activated materials are stored here as well and most of the storage areas are outdoors and exposed to the weather. They have been in use from the late 1960's until today. The area under the block yard and the material storage area as well as the parking area to the west was originally the main recharge basin for storm water run off from buildings 911 and 912.

Specific issues of note are:

1. The steel yard consists mostly of low carbon steel plate used for shielding and some structural steel materials. Because the steel may rust, a concern about contamination from activated oxidized steel washing into the soil has been addressed by OER. Soil samples taken as recently as September 1996 have been negative.
2. The shielding block yard contains "heavy" concrete shielding blocks which were made from ilmenite (FeTioz), an iron bearing mineral (hence the heavy). In a attempt to reduce cost of shielding, large iron pieces were added to ordinary concrete rather than using ilmenite. These blocks in this area have crumbled with age. Again soil testing in this area has been negative.
3. The lead storage yard has a shed area where the lead is kept under cover out of the weather to reduce surface oxidation. Prior to the mid-1980's some lead was stored outside. Soil testing for lead contamination has been identified as an action item.
4. There are two documented storm drains behind the steel yard and the material sorting area which would collect run-off from this area. A third storm drain was identified near the steel yard which does not appear on the site maps. Where this drain is routed is unknown at this time and will require further study. While soil testing has been done in these areas testing in the base of these storm drains may yield more information. This has been put on the action items list.
5. Experiment Equipment Storage Sheds SN 1-26 are for visiting experimenter's use. They are small 10' by 20' huts without services. They will be inspected over the next month to make sure they are being properly used.

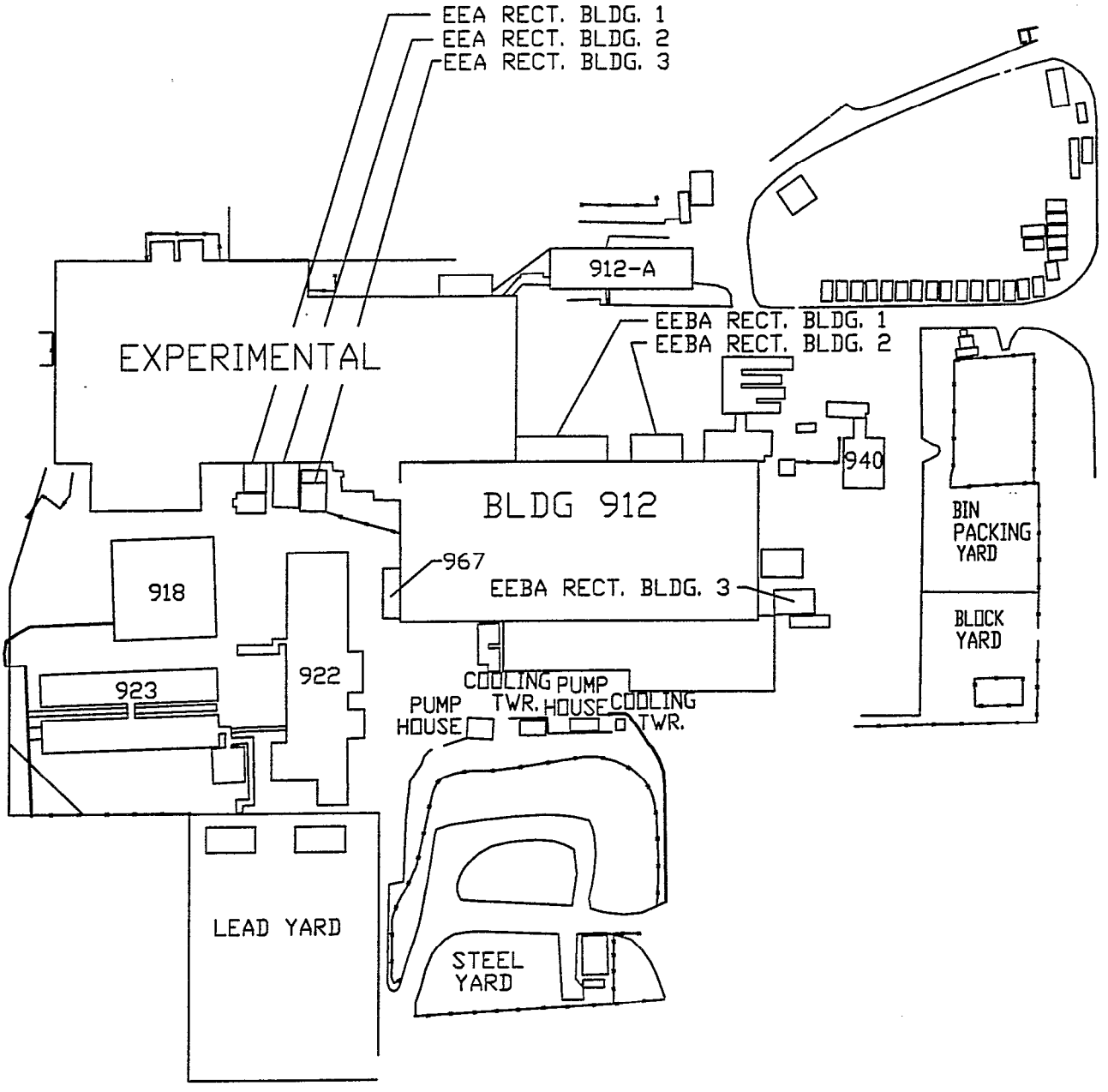
Documents Reviewed

1. "Historical Site Review Report", IT Corp., 1993
2. AGS Department Potential Environmental Release Points Questionnaire Nos. 09192-923, 09637-923, 20267-923, 08643-923, and 15430-923.
3. Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, New York Environmental Assessment, U.S. Department of Energy, DOE/EA #0909, March 1994
4. Evidence of payment under contract for disposal of BNL solid wastes at the Town of Brookhaven Sanitary Landfill for the period 12/13/83 to 05/09/97, Fax from M Zane to R. Skelton, May 9, 1997.
5. Alternating Gradient Synchrotron Department, Profile of Programs in: Environment, Safety and Health; Quality Assurance; and Conduct of Operations, December 1996
6. Integrated Safety Management Evaluation of the Brookhaven National laboratory, DOE Office of Environment, Safety and Health, April 1997
7. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National laboratory, December 1996
8. State Pollutant Discharge Elimination System (SPDES) Discharge Permit, Special Conditions (Part I) (SPDES # NY-0005835), New York State Department of Environmental Conservation, Issued 03/01/95
9. Air and Water Emissions Maps and Permits for Brookhaven National Laboratory, Internally derived index, No date
10. Characterization of Low level Radioactive Waste From the AGS Complex Including An Assessment of Pure Beta (ß) Emitters, E. Lessard, 11/1/95
11. Radiation Protection Studies During High Intensity Running at AGS, Radiation Exposure Around the AGS Ring and in the SEB Experimental Areas, Accelerator Division Technical Note No. 414, E. Lessard *et. al.*, March 14, 1995
12. Occurrence Report (Final Report), CH-BH-AGS-1995-0004, Alternating Gradient Synchrotron, Low Level Radioactive Material in Recharge Basin Where Not Expected, 03/04/1996
13. Occurrence Report (Final Report), CH-BH-BNL-AGS-1994-0007, Alternate Gradient Synchrotron, Contamination of Domestic Water Supply with Ethylene Glycol (Antifreeze), 08/04/1995
14. Occurrence Report (Final Report), CH-BH-BNL-AGS-1991-1004, Alternate Gradient Synchrotron, Unauthorized Release of Material to Building 930 Recharge Basin, 03/04/1996
15. Occurrence Report (Final Report), BNL 91-016, AGS 91-001, Alternate Gradient Synchrotron, Unplanned Halon System Activation at the AGS Multi-particle Spectrometer (MPS), 03/04/91
16. Memo E. Dale to R. Miltenberger cataloging AGS Water Systems, February 7, 1990
17.

Drawings Reviewed

D02-105-4, Rev. A, AGS Office Building - Site Plan and Details, 7/8/63

1. D02-106-4, Rev. A, AGS Office Building - Floor Plan and Elevations, 7/8/63
2. D02-107-4, Rev. A, AGS Office Building - Heating and Air Conditioning, 7/8/63
3. D02-108-4, Rev. A, AGS Office Building - Plumbing, 7/8/63
4. D02-109-4, Rev. A, AGS Office Building - Electric Light and Power, 7/8/63
5. 02-110-4, Rev. A, AGS Office Building - Fire Alarm and Telephone, 7/8/63
6. D02-122-4, Sheet 1, Rev. B, Architectural, 11/3/65
7. D02-122-4, Sheet 2, Rev. B, Floor Plan and Elevation, 11/3/65
8. D02-123-3, Fire Alarm System, 11/3/65
9. D02-125-4, Electrical, 11/3/65
10. D02-476-4, Bldg #923 (HIF), Electrical Changes, 2/24/78
11. D02-477-4, Bldg #923 (HIF), Walls & Partitions Removal & Additions, 2/24/78
12. D02-500-4, AGS Floor Plan, Bldg #923, 9/9/88
13. Sanitary System Map No. 65, 1992
14. Storm Drainage Map No. 65, 1992
15. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
16. Drawing Set, Floor Drain Modifications, Project 7610, Lockwood, Kestler and Bartlett, Inc., June 1994
17. Sanitary System map, No. 64, 1992
18. Storm Drainage map, No. 64, 1992
19. Sewerage-Drainage map, No. 45, 1989
20. Sewerage-Drainage map, No. 44, 1989
21. Water and Gas map, No. 45, 1989
22. Water and Gas Map, No. 44, 1989


EEA RECT. BLDG. 1
EEA RECT. BLDG. 2
EEA RECT. BLDG. 3
912-A
EXPERIMENTAL
EEBA RECT. BLDG. 1
EEBA RECT. BLDG. 2
940
BLDG 912
BIN PACKING YARD
BLOCK YARD
967
EEBA RECT. BLDG. 3
918
922
923
COOLING TWR.
PUMP HOUSE
PUMP HOUSE
COOLING TWR.
LEAD YARD
STEEL YARD

BLDG 912

AGS Release Points Committee

PERP Report #4 The AGS Office Complex and Associated Facilities: Office, Control Room, Shops, Mechanical Equipment Facilities, Power Supply Area.

Facility description:

Building 911 is the main office for the AGS Department. It was one of the first structures built for the accelerator complex and has direct passageways to both the AGS tunnel (building 913) and the AGS experimental area (building 912). Building 911 also contains the main control room, the support building for the main magnet cooling system, the support building for the Westinghouse main magnet power supply (now the back-up power supply for the ring magnets), a high bay assembly area with magnetic field testing shops, and other light electronics, vacuum, and machine shops. When building 911 was first built it was roughly half its present size. It was the major support building for the accelerator containing the main ring power supply (the Westinghouse), the RF power supplies, cooling systems, a machine shop, and the technician shops. The Westinghouse unit is a 5500 hp motor driving a 12 phase alternator rated at 36 MVA, 7500 V, 2771 A at 846 rpm for powering the 240 AGS Ring magnets at reduced energy and duty cycle. The Pump Room houses about 15 pumps, including air conditioning units, supplying water at pressures to 300 psig. Because it cools water from the AGS ring it does contain activated water along with typical industrial water treatment chemicals. A major expansion of the office space in 1967 doubled the size of the building.

Building 925 is across the parking lot west of building 911. It is a metal frame and skin building which was built in 1967 for warehouse space. In the 1970's it became shop space and has been used that way to the present day. As a shops space there are concerns about the use of solvents, machining fluids, silver plating, and metal cleaning chemicals. There are no documented or known releases from this building but it does have floor drains. It is not shown on the building drawings where the floor drains lead to. This building was serviced by a cesspool which was tested and removed in 1994. The building's bathroom and sinks now go to sanitary.

Facility Buildings:

911A-C	Main Office Building and technician shops.
911MER	Mechanical Equipment Room for AGS tunnel water cooling equipment.
911Westinghouse	Westinghouse Power Supply Area.
925	RF Shop building and former warehouse.

Related Buildings:

Building 913, the AGS ring which is connected via a main entrance (south gate) way and via underground tunnels (south wiring tunnel).
Building 912, directly adjacent to 911 connected via underground passageway and tunnels.

Building Interior Issues:

1. There are activated components from the AGS ring which have been stored and repaired in the high bay area and shop areas of building 911 and 925 in posted radiation work areas.
2. Many of the floor drains in the 911 originally went to the storm water system. In the 1990's a program was begun to convert floor drains from the storm system to the sanitary system.
3. Floor drains and roof drains in 911MER still go to the storm water system. A major failure of the AGS water could release activated water to these drains. Because the system would shut down and the MER is the high point of the system no more than .05mCi of tritium would be released with a major failure.
4. Industrial water treatment chemicals are stored in the MER.
5. Further investigation of the floor drains in 925 is required.
6. The 911 sanitary system has always gone to the sanitary sewers system. Building 925 sanitary system went to a cesspool but was converted to the sewage system during the cesspool conversion project.
7. Oil is used in many different pieces of equipment: high voltage power supplies and transformers, lubrication of the motor generator, water pumps, and vacuum pumps. Most of the oil is in the Westinghouse area.
8. There are still capacitors used in the facility which have PCB's. They are all documented.
9. The use of cleaning solvents and silver plating by the different shops located in 911 and 925.
10. Mercury was used in power supplies in the Westinghouse area and in vacuum equipment in 911A. Two mercury spills occurred in 911A. One in the vacuum lab when a mercury manometer broke and one at the entrance to the high bay area when the mercury vacuum cleaner broke. Both were properly reported and remediated. Mercury is used only in a pressure gauge in the Westinghouse area at this time.
11. An acid cleaning facility was set-up on the first floor of building 911. It was decommissioned and removed because of safety concerns in the early 1990's. The acids were disposed of through the waste management group.

Building Exterior Issues:

1. The area outside of the Westinghouse roll-up door was used in the 1970's for disposal of TCA. It was thrown out on the asphalt to evaporate and also ended up on the soil adjacent to the asphalt.
2. Water cooling towers are located on the roof and the grounds around 911. Some contain activated water and water treatment chemicals.

3. An activated material storage area was located outside the AGS tunnel truck access door in the building 911 parking lot.
4. There are many outdoor transformers which provide power for the complex. These are covered by the transformer report.

Documents Reviewed:

1. Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, New York Environmental Assessment, U.S. Department of Energy, DOE/EA #0909, March 1994
2. AGS Booster Final Safety Analysis, AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton NY, February, 1991
3. Evidence of payment under contract for disposal of BNL solid wastes at the Town of Brookhaven Sanitary Landfill for the period 12/13/83 to 05/09/97, Fax from M. Zane to R. Skelton, May 9, 1997
4. Alternating Gradient Synchrotron Department, Profile of Programs in: Environment, Safety and Health; Quality Assurance; and Conduct of Operations, December 1996
5. Integrated Safety Management Evaluation of the Brookhaven National Laboratory, DOE Office of Environment, Safety and Health, April 1997
6. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National Laboratory, December 1996
7. State Pollutant Discharge Elimination System (SPDES) Discharge Permit, Special Conditions (Part I) (SPDES # NY-0005835), New York State Department of Environmental Conservation, Issued 03/01/95
8. Air and Water Emissions Maps and Permits for Brookhaven National Laboratory, Internally derived index, No date
9. Characterization of Low Level Radioactive Waste From the AGS Complex Including An Assessment of Pure Beta (ß) Emitters, E. Lessard, 11/1/95
10. Radiation Protection Studies During High Intensity Running at AGS, Radiation Exposure Around the AGS Ring and in the SEB Experimental Areas, Accelerator Division Technical Note, E. Lessard *et. al.*, March 14, 1995.
11. Occurrence Report (Final Report), CH-BH-BNL-AGS-1992-0004, Alternate Gradient Synchrotron, Oil Leaks onto Gravel in the Transformer Yard, 03/04/96
12. Occurrence Report (Final Report), CH-BH-BNL-AGS-1996-0002, Alternate Gradient Synchrotron, Oil Leaks Onto Gravel in Transformer Yard, 08/09/1996
13. Occurrence Report (Final Report), CH-BH-BNL-AGS-1994-0007, Alternate Gradient Synchrotron, Contamination of Domestic Water Supply with Ethylene Glycol (Antifreeze), 08/04/1995
14. Occurrence Report (Final Report), CH-BH-BNL-AGS-19924-0005, Alternate Gradient Synchrotron, Release of Effluent Via Un-permitted Release Point, 08/04/1995

15. Occurrence Report (Final Report), BNL 91-016, AGS 91-001, Alternate Gradient Synchrotron, Unplanned Halon System Activation at the AGS Multi-particle Spectrometer (MPS), 03/04/91
16. Occurrence Report (10-Day Update Report), BNL 91-017, AGS 91-002, Alternate Gradient Synchrotron, Chlorine Gas Leak from 150 Lb. Cylinder, 03/15/91
17. Memo E. Dale to R. Miltenberger cataloging AGS Water Systems, February 7, 1990

Drawings/Maps Reviewed:

1. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
2. Drawing Set, Floor Drain Modifications, Project 7610, Lockwood, Kestler and Bartlett, Inc., June 1994
3. Sanitary System map, No. 64, 1992
4. Storm Drainage map, No. 64, 1992
5. Sewerage-Drainage map, No. 45, 1989
6. Sewerage-Drainage map, No. 44, 1989
7. Water and Gas map, No. 45, 1989
8. Water and Gas Map, No. 44, 1989
9. Plumbing Details, Building 911 "As-Built" Building Drawing 9212.06FB-1C, 1957
10. Plumbing and Roof Drainage, First Floor, Building "As-Built" Drawing 9212.06-FB-1A, 1957
11. General Arrangement Plan, First Floor, building 911 "As-Built" Drawing 9212.06-RA-1D, 1957
12. Plumbing and Roof Drainage, Second Floor Plan, Building 911 "As-Built" Drawing 9212.06-RB-1B, 1957
13. DO2-400-4, Rev. A, AGS Staging & Assembly Building - General, 11/28/66.
14. DO2-402-4, Rev. A, AGS Staging & Assembly Building - Plumbing Plan, No date.

AGS Release Points Committee

PERP Report #5 Building 919 - The g-2/Bubble Chamber and Associated Facilities: High Bay Area, Compressor Room, Shops, Offices, Control Room, Mechanical Equipment Facilities, Power Supplies, Beam Transfer Line, and Target Area.

Facility description:

Building 919 was built in 1962 for an AGS experimental area and is still in use. The original design of the AGS incorporated a large extraction area for external AGS beams through the north conjunction area which is located under building 921. This large exit portal supported two secondary beam lines (beam 3/beam 4). The secondaries for the beam 3 line were created by an internal AGS target and beam 4 created secondaries by extracting protons from the AGS at I10 into a target in the north conjunction area. The secondaries were transferred across the concrete tarmac beyond the shield block exit from 913 to building 919. The high bay area of 919 housed the 80 inch bubble chamber which was in operation until 1978. The bubble chamber had both a cryogenic component and a large mechanical component driven by a high pressure oil hydraulic system. An entire complex of buildings was built to support this operation. This included the control room, a large compressor room to support the cryogenic refrigerator system, a cryogenic shop area, a machine shop, a mechanical equipment area for water cooling, and a warehouse.

When the bubble chamber reached the end of its run. The high bay area and control room were used as shops and assembly areas. The cryogenic shop continued to be used to support liquid H_2 target in building 912 and the other buildings became storage areas. This continued to the late 1980's when the area was modified for the g-2 experiment and the water cooling systems were used to support Booster operations.

The g-2 operations required a new secondary beam line and a new secondary beam production target. To save money and space in the AGS ring, the existing AGS fast extraction system which provides protons and heavy ions for the U-line (building 927) was used instead of extracting beam through the north conjunction area. A spur was built off the U-line to provide beam for the g-2 proton target.

Facility Buildings:

919	High Bay Area (g-2 ring and bubble chamber building). Control room, office area, technician shop area, compressor room, and mechanical equipment room.
919A	Cryogenic Group shop building.
904	Cryogenic Group Hydrogen Target Test Facility.
919B	Machine Shop Area and Technician Shop Area.
919C	Cryogenic equipment building.
919G	Compressor room (extension on 919).
921	Power Supply Building.
949	Target building and secondary transfer line for g-2.
975	Warehouse and shop area.

Related Buildings:

Building 927 This is the designation for the U-line which had a spur added to provide protons to the target in building 949.
Building 913 The AGS ring provided beam to the beam 3 and beam 4 lines at the north conjunction area during the bubble chamber days.
Building 914 The Booster is provided cooling water via underground piping from the mechanical equipment room and cooling tower in the 919 complex. This water cools heat exchangers. It is not activated.

Building 919

Building 919 consists of the large high bay area with a 20 ton crane which housed the bubble chamber operation and now supports the g-2 ring. Northeast of the high bay area is the control room area, a technician shop, a compressor room, and the water cooling system equipment room and cooling tower. After the bubble chamber was shut down the control room area became a shops area, a storage area, an office area and finally a control room again for g-2. West of the control room is the technician machine shop which has been used for this purpose throughout. Next to that is the compressor room for the cryogenic refrigerator which also houses the mechanical equipment room for the water cooling system. Water cooling tower #5 is located outside near building 919A. Between 919 and 919A is an outside storage yard which is also where a diesel motor generator set was located.

Interior Issues:

1. A release of tritium from a gas chronograph detector occurred in 1973 in the technician machine shop. The detector held approximately 250 mCi of Tritium. How much was released at the time is not known. Documentation for this release exists and it was remediated at that time by washing down the area with water. Any run-off from the wash down would have gone to the storm water drains and the 919 basin.
2. Many of the floor drains in the 919 still go to the storm water system. A leak in the transfer beam line water system could release activated water to the storm water system via a building sump with a sump pump. This sump also takes storm water run-off from the roof drains and the large concrete tarmac outside of the buildings. Shutting off the sump pump is not a solution because the sump will quickly fill with storm water. Modification to the storm water system plumbing or the floor drain plumbing is required. This is on the action item list.
3. The sinks and bathrooms for this building went to cesspools which were tested and removed from service as part of the cesspool to sanitary conversion project in the 1993.
4. Oil is used in many different pieces of equipment: high voltage power supplies and transformers, lubrication of compressors, vacuum pumps, and water pumps, and the hydraulic system for the bubble chambers. Releases to the floor drains would go to the storm water system. All of the documented leaks did not reach the floor drains.
5. There were capacitors in the facility which use PCB's.
6. Cleaning solvents and silver plating were used by the different shops which have occupied

the building over the years. There may have been releases to the sinks or floor drains.

Exterior Issues:

1. Water cooling tower #5 services the complex and building 914. It does not have activated water. But there are the normal industrial water system chemicals associated with its operation and the pump room.
2. In the material storage area outside the compressor room, oil drums may have been kept in the 1970's and 1980's. There is no memory of a release from those drums. They are no longer stored there. Inspection and sampling of the yard area for oil leaks may be necessary and has been listed as an action item.
3. The beam 3 and beam 4 lines (referred to as **building 919X** on the building forms) were built on the concrete tarmac between the north conjunction area and 919. The lines were inside of sheds with metal frames and siding. It is believed that the water cooling for the magnets in the line did **not** serve the target in the north conjunction area so there would not be measurable activation in the water. Any leak from the water system or from the mechanical roughing pumps which served the line would have gone to the cable trenches which ran under the tarmac. These trenches drain to the 919 storm water sump.
4. After the bubble chamber was shut down and the beam line magnets were removed, the sheds were used for storage. There is one record of activated components being stored at the site. There are no known releases from this activity.
5. Steam cleaning and power washing has been done on the tarmac. Soap solution is used which removes residual cutting fluids from the metal parts. Run-off goes to the storm water drain.
6. There was a trailer area northwest of building 919A and east of 919B. These trailers served as office space and a technician shop area. There were no water system connections in the trailers or other activities which are a concern. The trailers were removed in the early 1990's.

Building 919A Issues:

This is the shop area for the cryogenic group which supported the bubble chamber operation, builds and maintains the cryogenic targets in 912, and now also supports operation of the g-2 superconducting magnet cryogenic system. This metal frame building was built on a concrete slab. The concerns in this building are typical of shops areas: machining fluids, chemical solvents including TCA and CTC, and oil for vacuum pumps. This building also had cesspools which were tested and converted to the sanitary system. The floor drains and storm drains outside go to the storm water system.

Building 904 Issues:

This building is not located in the AGS facility but it is used by the cryogenic group technicians for hydrogen target testing. Other than small amounts of vacuum pump oil and cleaning solvents there are no issues associated with the operation of this building.

Building 919B Issues:

This large metal framed and metal skinned structure has been used as a machine shop and storage area since it was built in 1966. The bathrooms and sinks in this building were serviced by cesspools until they were tested and converted to the storm water system in 1995. The floor drains go to the 919 basin. The concerns in this building are typical of shops areas: machining fluids, chemical solvents including TCA and CTC, and oil for vacuum pumps. Also the AGS beam separator group has used this area to maintain their oil filled power supplies. The supplies do not use PCB oil and there are no records of spills from the supplies. There is a large trench on the north end of the building which drains to the storm water system.

Building 919C issues:

This service building has housed cryogenic gas handling equipment and a helium refrigerator since it was built. There are no environmental hazards associated with its operation.

Building 919E issues:

A small service shed off of 919 it houses vacuum pumps for the cryogenic system. There have been some small oil spills in this building which were contained on its concrete slab. This is listed in the building 919 forms.

Building 919G issues:

This building houses a helium compressor which served both the bubble chamber and the g-2 ring. The building is a metal framed extension of the 919 compressor room. There are no floor drains in the concrete slab floor. About 10 gallons of oil are used in the compressor. An oil processing unit was added in 1991. It can handle up to 50 gallons of oil. There is no record or memory of oil spills in this area.

Building 921

This building housed power supplies for the I-10 extraction system and for the beam3 and beam4 transfer line magnets. This metal framed building is built above the north conjunction area and has sleeves which travel down to the AGS tunnel. The power supplies did contain PCB capacitors and there was one recorded spill when they were removed in 1992. The spill was recorded and remediated at that time. The building presently houses power supplies and controls for the g-2 transfer line and equipment in the AGS tunnel.

Building 949 issues:

This new building houses the proton target which produces secondaries for the g-2 ring. The water cooled target is highly activated (>50 Rem immediately after the beam has been turned off). Building 949 is built into the side of the U-line and has extensive shielding. This building and its water cooled target have been reviewed extensively in accordance with present BNL and AGS policy. The beam line which runs between the target building and 919 contains water cooled magnets and vacuum pumps. The cooling water is shared with the target so it is activated. After the g-2 run is completed the cooling water will be tested to determine its level of activation (action item). Leaking cooling water or oil from the pumps could go to the floor drains as described in the building 919 section.

Building 975 Issues:

This building was originally built as a warehouse for the bubble chamber. It has cinder block walls, metal roof, and a concrete floor without floor drains. Photographic film for the bubble chamber was stored in a refrigerated room inside the building. There was no film processing done in the building. The building also had a bathroom which used the building 919B cesspool. It was converted to the sanitary system at the same time as 919B. In the late 1980's the building was converted into a machine shop area. Activated components have been stored in the building and in a fenced storage yard outside of the building. A shielded block house with a metal roof was built in the fenced yard in 1989 to keep the activated components out of the weather. In 1991 a cutting shop for activated components was built in 975 and used to cut inconel chambers from the AGS ring. After the job was completed the shop was disassembled and all of the tools were cleaned up and checked for contamination. There were no releases from that job. Steam cleaning of components is done in the fenced area. When the components are activated they are cleaned in an enclosed stainless steel chamber and all of the run-off is collected and sampled before disposal in accordance with laboratory policy. In 1991 over 250 activated chambers were cleaned and the cleaning water for every chamber was sampled. All of the samples were clean and were permitted for disposal in the sanitary water system.

Documents Reviewed:

"Manual of Plant Equipment, Bubble Chamber Project, Alternating Gradient Synchrotron", Stone & Webster Engineering Corp., May 1963
"1994 Site Environmental Report", BNL, 1994
"Historical Site Review Report", IT Corp., 1993
"BNL Comprehensive Tank Listing", 1997
Aerial photographs: #153.018, 92-816, 3-89; #153.018, 92-816, 3-90; #153.018, 92-816, 4-135
F. M.S. Davis letter, BNL, letter to Carson L. Nealy, DOE Brookhaven Group, subject: "Removal Action III Cesspools/Septic Tanks Activities Schedule; DOE-BHG Request (letter, Interagency Agreement (IAG) Schedules, A. C. Harvey to M. S. Davis, Feb. 24, 1997)"
"AGS Final Safety Analysis Report", editors D. Beavis, et al, August 11, 1993.

"1993 Environmental Map for Site Development Plan - Brookhaven National Laboratory - U.S. Department of Energy" (NOTE: this appears to be a valuable quick reference and element in OER, SEP, and PE's efforts to help prevent BNL and contract worker exposure to old releases and to prevent unwittingly exacerbating existing environmental problems via construction activities).
"Final Environmental Impact Statement, Brookhaven National Laboratory, Upton, New York", July 1977 (ERDA-1540, UC-2,11).
"Programmed Improvements to the Alternating Gradient Synchrotron Complex at BNL, Upton, New York", November 1993, US DOE/EA #0909.
"Integrated Safety Management Evaluation of the Brookhaven National Laboratory", April 1997, EH2MGT/04-97/02SH
"Brookhaven National Laboratory Tritium Modeling and Conceptual Design Review", April 9 & 10, 1997.

Drawings Reviewed:

Drawing 10469-RB-1A building 919
Drawing 10469-FB-1B building 919
Drawing 10469-FC-1A building 919
Drawing 10469-FC-2A building 919
Drawing 10469-FC-4A building 919
Drawing 10469-FC-4B building 919
Drawings 4415, 4415-M2 building 919A
Drawings 4818, 4818-S1, 4818-S2, 5421-M1 building 919B
Drawing 4785-A1 building 919E
Drawing 4779 building 919F
Drawing 4874 M-1, A-2, A-1-A Building 975
Drawing 7312-M1 919A, 919B, 975 sanitary system connections.

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PERP Report #6 Building 927 - The AGS Fast Extraction Beam Line "The U-Line"
Associated Facilities: U-line tunnel, Pump house, Power Supply house, Neutrino Target Area, Compressor Room, Shops, Offices, Control Room, Mechanical Equipment Facilities, Power Supplies, Beam Transfer Line, and Target Area.

Facility description:

The ~300 meter U-line (also called the north experimental tunnel) was added to the AGS facility in 1971. It received protons via a fast extraction system at the H-10 straight section in the AGS for neutrino experiments 613, 693, and 734. The transfer line magnets and components are contained in buried tunnel made from corrugated galvanized steel tubing 10 feet in diameter. At its end and around the proton targets it is heavily shielded. In 1996 it provided heavy ions to the RHIC facility via a tunnel added near the north end of the line in 1979. Because of the record proton intensities produced by the AGS there is renewed interest in using the U-line facilities. The g-2 experiment uses the fast extraction system and the upstream (south) end of the line to transfer high intensity proton beams for its target. The neutrino horn is no longer in the tunnel but that area is now being set up for three different experiments which will use protons from the AGS. The line will also be providing heavy ions for RHIC operations from 1999 onward. All of the new operations in the U-line have and will be reviewed and approved in accordance with AGS Department and Laboratory policy.

In its original configuration, the U-line had a proton target near the north end of the line in the well shielded area of the tunnel. Immediately downstream of the target in the tunnel was a high current pulsed solenoid magnet which focused the secondaries before they decayed to neutrinos. This target and focusing assembly were referred to as the neutrino horn. There were two different horn designs used during the life of the program. Both were installed in the same general area in the tunnel. The experimental detectors were located outside of the tunnel at its north end. The first detector was the 7 foot bubble chamber which was in operation from 1973 to 1978. It was housed in a wood frame building referred to as 960. In the late 1970's to the mid 1980's oil filled scintillator detectors were installed in the experiment 613 block house (no building #) and building 965. Building 965 was immediately north of the bubble chamber building and the 613 block house was north of 965. Another neutrino detector was installed in the middle of the RHIC ring in building 1101.

Associated with the neutrino experiment operation were a pump house for cooling water, the neutrino horn power supply house on top of the tunnel, two beam-line magnet power supply houses, and a storage block house for activated components. Building 960 housed the bubble chamber with its associated hydraulic system and cryogenic system and various support buildings. The experiment 613 block house and building 965 housed the oil filled scintillators and were supported by storage tanks, office and technical support trailers and service buildings. The building 1101 housed neutrino detectors with little environmental concern. The Exp. 613 blockhouse and building 965 have been removed along with their support buildings and tanks, building 965 is empty, and building 1101 is now a RHIC warehouse. Some of the other trailers and support buildings remain. On the west side of the line there was a large tarmac used for experimental trailers. The pump house is also on this tarmac which extends south to the tarmac for the 919 facility. The neutrino horn power supply house still sits on top of the berm above the beam line.

Facility Buildings:

927	The U-line tunnel
927A	Neutrino Pump House
927X	Neutrino Horn Power Supply House
927X	The horn storage block house
927X	FEB A-House
927X	FEB B-House
965	An experimental detector block house

Exp. 913 house - an experimental detector block house
("X" is used because the building do not have plant engineering assigned building numbers)

Related Buildings:

913	The AGS ring provides beam to the U-line via a 8" diameter by 30 foot long steel pipe buried in the ground between the two tunnels.
960	The bubble chamber building is covered by the RHIC Department Report.
961, 962, 963	Bubble chamber support buildings are covered in the RHIC Department Report.
1005	The RHIC Beamline tunnel.
1101	RHIC warehouse; formerly a detector building for the U-line experiments.

Building description:

The tunnel is described in the facility description section above. The neutrino power supply house, the FEB A-house, and the FEB B-house are all metal frame and metal sided buildings. These buildings do not have floor drains.

The first neutrino pump house building in use from 1972 to 1983 was metal framed and sided with a wooden floor. It was placed on the concrete tarmac which ran along the west side of the U-line. A major leak in the pump house would flow through the floor to the concrete tarmac surrounding the building to the soil or the storm drains. A new shielding block house was built in 1984 to house the pumping equipment. This building also had a 550 gallon water storage tank to hold the water during maintenance and repair. The tank was removed in 1996. There were no known leaks from the tank.

There were support trailers outside of gate 5 on the west side of the line which were used for technical supports. Chemical solvents such as TCA and silver plating materials were used in and around the trailers. Any releases would have gone to the storm water system and the 927 or RHIC basins.

The Experiment 613 block house was built on steel plates instead of a concrete floor. Whether any oil leaks in the block house migrated beyond the plates is not known. Further review of this issue is an action item. The horn storage block house and the 965 detector block house were constructed of shielding blocks on a concrete pad. The storage block house does not have floor drains. The concrete floor for building 965 had an outside wall which contained any releases of oil in the building.

Building 927 (tunnel) Interior Issues:

1. The tunnel itself has concrete floors with floor drains. The floor drains go into a sump which is located under the tarmac on the east side of the line. The sump went to the storm water system until 1994 when it was converted to the sanitary system as part of AGS system upgrade. There are still trenches at the upstream end of the tunnel which drain into the storm water system. Converting them to the sanitary system is on the action item list.

2. There were activated water spills in the tunnel and in the pump room outside of the tunnel. It is estimated that 16 mCi of tritium may have been released during the life of the neutrino horns operation.

3. PCB oil filled capacitors were used in the termination assembly of the neutrino horn. There were no records or memories of leaks.

4. Lead and lead wool shielding were used in the tunnel. The lead became highly oxidized in the tunnel. It has been cleaned up but there may be some left in the floor drains. An action item is to test the floor drains.

5. At the present time an experiment is being prepared to test mercury for use as a proton target material. The test target contains 43 liters(580kg) of liquid mercury metal. There is an additional 10 liters in the storage vessel. Both the target and the storage vessel have secondary containment. Transfer of the mercury is done by a low pressure, gravity feed system. The mercury will be irradiated in a series of exposures of 10^14 high energy protons from the AGS (5 to 10 exposures) in the heavily shielded area (old neutrino horn area) of the U-line tunnel. Each exposure will initially generate about 0.5 Ci of activity, but a month's cool down will reduce that level to less than 0.5 mCi. The pressure wave generated by the short duration proton bunches has been calculated by two different codes to be well below the yield limit of the stainless steel target container. As with all other AGS experiments, the AGS safety review committees have formally reviewed all conventional safety and radiation safety issues.

Building 927A (pump-houses) Interior Issues:

1. Water from a closed loop system in the pump house was used to cool the neutrino horn target assembly. The water was activated. As described above a total loss of 16 mCi or tritium may have been released from both the tunnel and the pump house combined. This water would have gone to the soil, 927 basin or the RHIC basin. The estimate is based on water activation in present target stations in the AGS which receive similar beam fluxes.

2. A tank for storing the cooling water rather than releasing the water was installed and used in the 1980's when the pump house was upgraded. The tank has been removed and there were no records or memories of leaks from the tank.

Building 927X (Power supply house) Interior Issues:

1. PCB oil was used in the power supply house and in the transformers for the power supply house. There were two known leaks. One occurred in a cabinet in the power supply house. The lost oil was contained in the cabinet and cleaned up at that time. The other leak occurred

in the transformer yard in 1983. The leak was remediated at that time by removing soil.

2. There were 40 ignitron tubes in the power supply housed which contained ½ ounce of mercury per tube. There was some breakage and the mercury was cleaned up each time. There was no known release of mercury to the environment.

Building 927X (The neutrino horn storage block house) Interior Issues:

This block house on the East side of the line has been used to store the horn. The house was located outside of gate #3 and a track system was designed to allow easy transport of the horn after it was decommissioned in 1986. In the block house time is providing a reduction in the horns activation before it is disassembled, packaged, and shipped off site to a activated material depository. The reduced activity gained by the extended storage will reduce the radiation exposure to BNL personnel and others who will handle the horn removal.

Building 927X (FEB A-House) Interior Issues:

This house had power supplies with PCB capacitors and water cooled equipment. There was no documentation or memory of PCB releases in the building. The water cooled equipment shared the water with the u-line transport magnets. There have been small leaks totaling <200 gallons over the life of the building for an estimated release of <15 μCi of tritium.

Building 927X (FEB-B house) Interior Issues:

There is no record or memory of a problem with this power supply house. It is built on a concrete slab and was most recently used to store and transfer mercury for the mercury target experiment. Secondary containment, a mercury vapor monitor, and an active review program were used during the transfer. There are no floor drains in the building.

Building 965 (E734 detector block house and the North Experimental Area) Interior Issues:

As described above, the building 965 block house housed a detector for E734 from the late 1970's to 1985. The detectors used a 50% mineral oil/50% trimentnyl Benzene scintillator fluid. During normal operations it was estimated that 5 gallons/year of the fluid may have leaked to the concrete floor. There were no floor drains and there was no documentation or memory of the oil reaching the floor trenches and flowing outside of the building. The oil which reached the floor was cleaned up with speedy-dry type absorbents and disposed of in accordance with Laboratory policy at that time. There was underground piping and one 275 gallon underground oil storage tank along with two above ground tanks. There was one spill outside of building 965 in an adjacent oil transfer house during operations in the early 1980's. 50 to 100 gallons were lost to the soil around the house. The incident was reported at the time of the spill and remediated by soil removal in 1989 when the experimental area was disassembled. The underground storage tank was also removed in 1989. There was no indication that the tank was leaking. There was a leak of oil when some of the underground piping was damaged during removal operations. That incident was also reported and remediated by soil removal at the same time.

There was a small closed cooling system which used glycol antifreeze but was not activated. During maintenance some of the antifreeze may have been released to the ground or to a near by storm water drain. There was some activated steel and concrete shielding block used in the area.

Most of it has been removed.

The North Experimental Area consisted of some temporary buildings and trailers north and east of 965. They have been removed. The only remnant is a cesspool for the area bathroom which does not show on the site drawings and has not been tested. It is on the action item list.

Exterior Issues:

The following exterior issues were discussed above and are repeated here:

1. There was a leak of PCB oil from the transformer on top of the 927 tunnel next to the power supply house. The leak was reported and remediated when it occurred (1983).

2. There were oil tanks and oil associated with building 965. Some of the piping ran underground. The tanks and some of the piping. The piping which remains must be evaluated to determine if it is a potential environmental hazard.

3. Photographs from the late 1970's show that 55 gallon drums were stored outside near the north experimental area buildings. Whether they contained oil or there was a spill is unknown. Testing of this area is on the action item list.

Documents Reviewed:

"1994 Site Environmental Report", BNL, 1994
"Historical Site Review Report", IT Corp., 1993
"BNL Comprehensive Tank Listing", 1997
Aerial photographs: #153.018, 92-816, 3-89; #153.018, 92-816, 3-90; #153.018, 92-816, 4-135
MS Davis letter, BNL, letter to Carson L. Nearly, DOE Brookhaven Group, subject: "Removal Action III Cesspools/Septic Tanks Activities Schedule; DOE-BHG Request (letter, Interagency Agreement (IAG) Schedules, A. C. Harvey to M. S. Davis, Feb. 24, 1997)"
"AGS Final Safety Analysis Report", editors D. Bevies, et al, August 11, 1993.
"1993 Environmental Map for Site Development Plan - Brookhaven National Laboratory - US Department of Energy"
"Final Environmental Impact Statement, Brookhaven National Laboratory, Upton, New York", July 1977 (ERDA-1540, UC-2,11).
"Programmed Improvements to the Alternating Gradient Synchrotron Complex at BNL, Upton, New York", November 1993, US DOE/EA #0909.
"Integrated Safety Management Evaluation of the Brookhaven National Laboratory", April 1997, EH2MGT/04-97/02SH
"Brookhaven National Laboratory Tritium Modeling and Conceptual Design Review", April 9 & 10, 1997.
"Scintillation Fluid Spill," memo from R. Casey to D. Lowenstein/P. Bond dated September 26, 1989.
"Remediation of the spill at Bldg. 965," letter from Wailin Litzke to Mr. Misbahuddin Mizra, August 29, 1989.
"15 to 20 gallon Scintillation Oil Spill," IIR No. 89-5, BNL Investigated Accident Report, October 10, 1989.
"Scintillation Oil Spill at Building 965," letter from Gerald C. Kinne to Mr. Jerry Bellows,

October 6, 1989.
"Spill of Scintillator Fluid," AGS and Accelerator Development Divisions Injury/Incident Report No. 89-18, July 31, 1989.

Drawings Reviewed:

Drawing 7312-M1 919A, 919B, 975 sanitary system connections.
DWG. D-14-1016-C6, Rev. A1, "AGS North Experiment Area NEA, Cons. DWG. Of expt. #734."
"Storm System," 4/24/97.
"Sanitary System," 5/7/97
2484-424-C1 Site plan
2484-424-C3 Drainage details
2484-424-M1 Yard piping
7610-14 Cross connections between floor drains & storm system eliminated

Report #7

AGS Release Points Committee

PERP Report #7: Supplemental Report on The Cooling Water Systems for the AGS Department.

AGS Cooling-Water Systems Description:

In the previous AGS PERP reports the role of the cooling water systems has been defined. The term primary-water is meant to imply that there is a potential to activate the water. Several dedicated primary-water cooling systems are distributed throughout the magnet enclosures, supplying cooling water to magnets, targets and rf cavities. Additionally, primary-water systems are routed through the enclosures to cool external devices. For example, chilled water is distributed through the AGS ring to the fan houses where it is used for the ring air-conditioning system. Prior to disposal, primary-water is sampled for radioactivity and metals even if the water is not expected to be radioactive. Water samples are obtained using "Chain-Of-Custody" formality and are labeled to identify date, building number, and system name. If an effluent is intended, either by collecting spilled water in a sump or by draining down a system, then the sample results are used to determine if the effluent may be sent to the S&EP Hazardous Waste Management Group, or to the sanitary sewer for disposal. The S&EP Division makes all decisions regarding the choice of correct disposal pathway.

Primary water in cooling systems may contain 12.3-year half life tritium and trace amounts of other shorter-lived radioactivity (e.g. Be-7, Na-22). With the exception of experimental-area cooling towers, primary-water systems are closed and are sampled prior to any planned release. Primary water is normally polished by ion exchange and is not changed-out very often, if at all. Ions are removed from primary cooling water because ions allow electric fields to be created around brass connections which in turn causes the brass to be dissolved away. Major changes to primary-water systems may occur every decade or so, and, in recent years, primary water has been held and returned to the system after the work is done. Thus, discharges of primary water are normally related to leaks in the system, which occur once or twice per year at a level of several hundred gallons.

Water Release Issues:

Leaks from primary-water systems are collected by a network of floor drains. Primary water entering the floor drain system is in most cases conducted to the sanitary sewer system directly or is collected in sumps. In those cases where radioactive water is collected in sumps, automatic pumps are turned off and the sumps are alarmed with level indicators. The water is held in the sumps or transferred to storage tanks and then analyzed prior to discharge. In areas such as the Booster (buildings 942 and 914) and the experimental floor (building 912) the water leaks would be conducted directly to the sanitary system. At the waste water treatment facility, ponds can hold the water if necessary. However, as shown in the following table, the total tritium in all AGS systems

is about 18 mCi. To put this amount in perspective, BNL releases 1500 mCi of tritium in a typical year to the Peconic River, and 80,000 mCi of tritium to air under NYS permits as a result of non-AGS operations. As discussed in the facility reports, losses in some systems (911A Mechanical Equipment Room (MER), 930 MER, 927 (U-line), and 919) can result in water being released through the floor drains to the storm water system. Conversion of some building floor drains from the storm system to the sanitary system has been completed. Some however are still connected to the storm system.

As previously indicated the total amount of tritium in all AGS water systems is about 18 mCi at this time. A system by system listing of the tritium in primary waters is as follows:

AGS Primary Water System Name	Approximate Volume, gallons	Tritium Concentration on March 11, 1997, µCi/mL	Total Tritium Activity, mCi
AGS Main Magnet System	8000	2.83E-04	8.57
AGS Chilled Water	1000	2.87E-05	0.109
AGS Fast Quad	1000	6.47E-05	0.245
AGS RF Cavity	1000	Below MDL MDL is 3.32E-06 µCi/mL for tritium.	-
AGS RF Power Amplifier	2500	2.12E-04	2.10
AGS Special Experimental Magnet (SEM)	2000	2.49E-04	1.89
Linac Transport	1000	Below MDL	-
Linac Tank	1000	1.97E-05	0.0746
BLIP Beamstop	750	1.36E-03	3.86
Booster Magnet and Amplifier	2000	1.64E-04	1.24
Booster RF Cavity	500	6.13E-05	0.116
RHIC Injection, X and Y	1000	4.44E-06	0.0168
AGS F10 And F10 Cooler	500	9.14E-05	0.173
C Line Special Cooling	300	Below MDL	<.5 mCi
AGS Tower #1	15000	Below MDL	<.5 mCi
AGS Tower #2	2000	Below MDL	<.5 mCi
AGS Tower #3	2000	Below MDL	<.5 mCi
AGS Tower #4	15000	Below MDL	<.5 mCi
AGS Tower #5	10000	Below MDL	<.5mCi
Total Tritium Activity In All AGS Systems	-	-	18.3

Water handling methods in the 1960's, 1970's, and early 1980's were different than they are today. Water was released to the floor drains and to the storm water system when maintenance was performed instead of being held and tested. Estimates of the water released in the past are included in the level 3 forms in the different facility reports. It should be noted that the levels of tritium in the water were an order of magnitude or more below today's levels because the AGS intensity was significantly lower than it is today.

The secondary side of closed-cooling systems is well water and cooling tower water, with the addition of treatment chemicals. Under normal conditions the secondary water does not become activated. In 1994 the AGS main magnet heat exchanger was replaced to prevent leakage to the secondary water. Water treatment chemicals are also added to Cooling Towers #1 through #5. The AGS staff relies on Drew Chemical, a sub-contractor, to manage the chemicals used in AGS cooling waters. Drew Chemical has monitored all of the automatic systems used to add rust inhibitor and biocide. Drew Chemical does the weekly analysis of chemical concentrations. Each week, Drew Chemical provides a service report to the AGS Mechanical Services Group with recommended adjustments to feed rates for each system. Drew Chemical has provided training for the AGS Mechanical Services Group periodically on water treatment and the safe handling of chemicals. Traditionally, cooling waters which contain water treatment chemicals are released to recharge basins on the BNL site. These recharge basins are monitored periodically by the S&EP Division to insure that releases are within the limits of SPEDES permits.

Airborne Radioactivity From Cooling Towers At AGS:

Most of the primary cooling water systems are closed. There is no exchange other than heat between the primary cooling water and well water and no emissions to air. There are four open cooling towers that cool the water from magnets in experimental areas in Building 912. Studies of radiation levels associated with emissions to air from the open cooling tower were performed in 1995 when the AGS had run at high intensity for an extended (25 week) period. These studies showed that emissions from the towers (#1, #2 (CT2), #3 and #4) are far below the threshold for the EPA – compliant monitoring levels of .1 mrem/year specified in the NESHAPS regulation (40 CFR 61, -Subpart H).

In 1995, the radiation levels at CT2 were 20 to 100 times greater than the levels at the other three towers. The difference is due to higher than average proton-beam interactions in the C Line magnet cooling water, which in turn feeds water to CT2. Also, the small volume of the CT2 water system raises the concentration of radioactivity in this water. CT2 water in the cooling system is exposed to air as it enters the top of the tower which is about 10 m off the ground. Some water is added to CT2 make up for evaporative losses, but most of the water ends up back in the magnet cooling system via piping back from the tower.

Cooling Tower #2 radiological studies in 1995 were used to illustrate the dose issues. The following gaseous radionuclides emanate with the evaporative losses from CT2 during AGS operations:

Nuclide	O-14	O-15	N-13	C-11
Half life, minutes	1.2	2.1	10	20

Measurements made and reported in 1995 have shown the emanation rate of C-11 and O-15 from CT2. About 0.04% of these dissolved radio-gases is emanated to air. In the 1995 report, dose to off-site and on-site persons was estimated. Variations in wind speed, wind direction, and diffusion were estimated by determining a range of potential dose values rather than a single value. The expectation values for dose were as follows:

Dose Quantity	High	Low
Range of annual dose to a person located at the site boundary, mrem	0.003	0.000030

These emissions are at least 33 times less than the threshold EPA compliant monitoring level of 0.1 mrem in one year.

In 1995, an analysis of dose was also performed for on-site personnel. "Close-in" factors were considered; for example, the plume looping back on itself during periods of low wind-speed. Also, the proximity of Buildings 912, 911, 918, 923 and 922 to CT2 tends to trap the plume. This decreases the turbulence or movement of air and increases dose close-in. These fumigating or looping conditions were accounted for in the estimate of dose to on-site personnel, and the range of annual dose was:

Dose Quantity	High	Low
Range of annual dose to an employee who works 40-hours per week at 100 meters from CT2, mrem	3.0	0.0018

This level is much less than the BNL guide of no more than 25 mrem in one year to on-site personnel who are in non-AGS facilities.

Actions Taken:

With regard to the dose from the cooling water towers, the S&EP Division set out 25 TLD dosimeters which measured the low doses predicted by the plume studies in 1995. These TLDs were located throughout the occupied offices of Building 911 which is the closest non-radiological area relative to CT2. These measurements supported the 1995 plume studies. These measurements show that low dose is also being received from "shine" directly from cooling-water piping near Building 911.

Since 1995, radiation dose from plumes from cooling towers has been further characterized and has been lowered where practicable. In 1996, a heat exchanger was added to CT2 which allowed partial closing of the C-line cooling system. In 1995, 1996 and 1997, the C Line was re-tuned to reduce beam loss and radioactivity in CT2 cooling water. These efforts have resulted in an estimated 4-fold reduction in dose from CT2 plumes.

Specific Future Actions:

The AGS has added shielding to piping which carries slightly radioactive water and causes a source of radiation "shine" to personnel. This additional shielding is expected to reduce employee exposure to direct radiation from water piping near building 911.

Exposure of personnel to water piping "shine," while not directly related to cooling-tower plumes, accounts for most of the AGS personnel exposure from cooling-water systems.

An ad hoc AGS Hot Water Committee has been active since 1995 and continues to be apprised of measurements on or near cooling waters, and continues to review long-term and short-term options for dose reduction. As a result of their continued review, Activity Data Sheets and requests for GPP funds have been submitted in order to close all open cooling-water systems. This long-term solution is sought because the water in these cooling systems is exposed to air as it moves through the cooling towers. The best solution to reduce emanations of radio-gas is thought to be via heat exchangers such that the primary water in magnets stays in a closed loop inside a shielded area. This solution not only eliminates emissions from cooling towers it also reduces AGS worker exposure to 'hot' piping.

Documents Reviewed:

Lessard, E.T., Editor, AGS Final Safety Analysis Report, AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 19973, August 11, 1993.

Lessard, E.T., and T. Sperry, Programmed Improvements of the Alternating Gradient Synchrotron Complex, Environmental Assessment, Brookhaven National Laboratory, Upton, New York, 11973, DOE/EA #0909, November 1993.

Lessard, E.T., K. Reece, and R. Miltenberger, Radiation Protection Studies During High Intensity Running at AGS, Radiation Exposure Around the AGS Ring And in the SEB Experimental Areas, AGS Department Technical Note, Brookhaven National Laboratory, Associated Universities Incorporated, Upton, New York, 11973, March 1995.

1994 Site Environmental Monitoring Report, Safety and Environmental Monitoring Division, Brookhaven National Laboratory, Associated Universities Incorporated, Upton, New York, 11973, May 1995.

AGS Release Points Committee

PERP Report #8 The AGS Warehouses:

Facility description:

The AGS Department has used warehouse space throughout the its facility and the Laboratory. If there was space available the AGS used it. As discussed in previous reports the AGS also stored materials outside Building 912, 919, 975, in the inner mongolia area of the AGS, the southwest area, and in the ISAbelle experimental buildings. The major issues with AGS storage are:

1. Activated materials are stored. When a part fails in service in the accelerator tunnels or the experimental lines it is often replaced with a spare. After a radiation cool down period the component is repaired and stored until needed. Also when experiments end and beam lines are no longer needed magnets, shielding, and other components are saved and recycled instead of being disposed of. This has significantly reduced our hazardous waste stream.
2. Power supplies which were saved and recycled had PCB capacitors which would leak while in storage. When they were discovered they were reported and remediated. Power supplies in storage with PCB's are logged and tagged.
3. Magnets and other water cooled devices were often stored in unheated spaces. The cooling lines had antifreeze in them which have the potential to leak to the ground. Also the water system chemical themselves are stored.

Facility Buildings:

<u>918 Warehouse</u>: This building is located adjacent to the building 912. It was built in 1957/58 during the AGS construction. It has a metal frame and metal sided construction. It was a warehouse from the start and always used for that purpose. It was doubled in size in 1962. Stored in it are activated components, PCB capacitors, water system chemicals, and vacuum pumps which contain oil along with many new components. There are no floor drains so small leaks would be contained on the concrete floor. This building has a bathroom which drains to a cesspool. The cesspool was not documented and included in the cesspool conversion project. It is believed that the trades trailer sink also drains into this cesspool and it is possible that other trailers may have used the cesspool as well. That cesspool is on the action item list for identification/documentation and testing.

<u>936 Warehouse</u>: This building is located east of building 912 and the rest of the AGS facility. It was built in 1980 and has always been used as a warehouse. It has a metal frame and metal sided construction and a concrete floor with floor drains which run to the sanitary system. It also has an outdoor storage area and an outside storage shed. There are a number of power supplies stored in the building with PCB capacitors. There is one documented leak which occurred in 1993. It was reported and remediated at the time. There was a coil stripping operation in the shed and the copper in the coils were activated. Testing of the stripped insulation at the time did

not indicated an activation concern. Some of the fiberglass and epoxy insulation may have gone into the floor drains to the sanitary water system.

196 Warehouse: This wood frame building was built in 1942. It was formally abandoned and demolished in 1995. The building was used by the AGS department for storage from 1975 until it was abandoned in 1991/92. The building housed depleted uranium, lead, activated copper magnet coils, vacuum pumps with oil, and other activated components. Tests were done on the building before decommissioning.

Building 209: This warehouse belongs to the S&EP division. The AGS has been storing activated components (magnets, jacks/stands, and coils @ <5mR) in the building since 1995. There is no concern with its operation.

Building 424: Was built in 1942 for Camp Upton as its theater. The AGS began storing activated components and power supplies with PCB capacitors there from 1973 until it collapsed in 1996. After the building collapsed it was totally demolished, all equipment and debris was inspected and stored again or disposed of in accordance with Laboratory policy. The building had a concrete floor with floor drains which went to a drywell. The drywell was inspected by S&EP before it was filled in as part of the demolition project. There was one recorded release of PCB oil to the floor in 1993. It was reported and remediated at that time.

Building 178: This building was built in 1922 as a theater/lecture hall. The AGS began storing activated components there in the early 1970's. Because the building was wood frame and in a "populated" area the levels of activation was low and much of the equipment was new spares. There is no memory of PCB power supplies or other oil filled equipment being stored there or other environmental hazards. The AGS equipment was removed and the building was demolished in 1992.

Buildings 925 (PERP #2) and 975 (PERP #5) had served as warehouse facilities before being converted to shop areas. There is no information of note for either building. Outdoor storage around buildings 912 (PERP #4) and 913(PERP #2) is dealt with in those reports.

Documents Reviewed:

1. Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, New York Environmental Assessment, U.S. Department of Energy, DOE/EA #0909, March 1994
2. Alternating Gradient Synchrotron Department, Profile of Programs in: Environment, Safety and Health; Quality Assurance; and Conduct of Operations, December 1996
3. Integrated Safety Management Evaluation of the Brookhaven National Laboratory, DOE Office of Environment, Safety and Health, April 1997
4. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National Laboratory, December 1996

5. Characterization of Low Level Radioactive Waste From the AGS Complex Including An Assessment of Pure Beta (ß) Emitters, E. Lessard, 11/1/95
6. Alternate Gradient Synchrotron Department Spill Report Number 93-10, Building 936 (PCB spill), 4/14/93.
7. S & EP reporting form 93-11, building 424 (PCB spill), 4/20/93
8. Memo E. Dale to R. Miltenberger cataloging AGS Water Systems, February 7, 1990

Drawings/Maps Reviewed:

1. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
2. Drawing Set, Floor Drain Modifications, Project 7610, Lockwood, Kestler and Bartlett, Inc., June 1994
3. Sanitary System map, No. 64, 1992
4. Storm Drainage map, No. 64, 1992
5. Sewerage-Drainage map, No. 45, 1989
6. Sewerage-Drainage map, No. 44, 1989
7. Water and Gas map, No. 45, 1989
8. Water and Gas Map, No. 44, 1989
9. Drawing No. DO 2-46-3 Rev. A, 7816-S1, and -S2 building 918
10. File # 7453-152 drawing for building 424

AGS Release Points Committee

PERP Report #9 AGS Power Transformers

Facility Description:

The AGS department is responsible for 90 power transformers that contain dielectric insulating and cooling fluid. These transformers, which are used for power distribution and for energizing specialized pieces of scientific apparatus, are located in various transformer yards throughout the complex. All installations were in full compliance with the regulations regarding oil containment and fire loss prevention at the time of their installation. A BNL loss prevention and containment project has been underway for two years to upgrade older installations to modern standards. Of the four transformer yards which require additional containment, two have already been upgraded and work will begin soon on the remaining two yards. In addition, twenty-one oil filled transformers will be replaced with new silicone filled units. Silicone dielectric fluid is environmentally benign and does not require secondary containment. When this project is completed in the summer of 1998 all transformers and yards will be in complete compliance with present regulations. At present all transformer yards are inspected for signs of oil leaks on a regular basis.

Related Facility Buildings:

The transformers are located throughout the AGS Department as listed on the attached table 8.1.

Environmental Issues:

1. There have been leaks of oil from the transformers in the past. The old containment systems allowed the oil to leak to the ground.
2. In the 1950's and 1960's PCB oil was used in transformers. Some of the AGS transformers used this oil. They were identified drained and flushed in the 1980's.
3. The new containment systems have concrete containment around the transformer yards. These systems must be inspected to make sure that the containment dikes are drained properly.
4. The smaller transformers do not require secondary containment. They are on a monthly inspection schedule.

Table 8.1: Transformers in the AGS Department

T	LOCATION	KVA	MFG	Oil Vol.	comments
913	inside Ring	2500/3125	General Electric	309	Below SCDHS Limits
911-N	911	2500/3125	BBC	331	Below SCDHS Limits
A-1000	911	1000	Westinghouse	268	retired 97
A-1500	911	1500	Westinghouse	329	To be replace w/silicone, 1998
B-1500	TAR BLDG	1500	Westinghouse	623	retired 97
B-2000	TAR BLDG	2000/2300	Westinghouse	750	To be replace w/silicone, 1998
C-1500	TAR BLDG	1500	Westinghouse	623	retired 98
C-2000	TAR BLDG	2000	Westinghouse	750	To be replace w/silicone, 1998
D-1	914	1000	Westinghouse	513	retired 97
D2	Bldg 914	2500/3500	Siemens(Baltau)	550	new silicone
E	918-NORTH	2500/3125	PENNSYLVANIA	831	containment
F-1	912A-WEST	2500/3125	PENNSYLVANIA	831	To be replace w/silicone, 1998
F-2	912A-WEST	2500/3125	PENNSYLVANIA	831	To be replace w/silicone, 1998
F-3	912A-WEST	2500/3125	RTE- COOPER	514	RTemp
G-1	EEBA-NORTH	2500/3125	PENNSYLVANIA	831	To be replace w/silicone, 1998
H-1	g-2	2500/3125	PENNSYLVANIA	831	To be replace w/silicone, 1998
H-2	914	2500/3125	BBC	483	Below SCDHS Limits
J-3	WEST TAR	2500/3125	Westinghouse	450	Below SCDHS Limits
K-1	EEBA	2500/3125	Westinghouse	450	To be replace w/silicone, 1998
K-2	EEBA	2500/3125	Westinghouse	450	To be replace w/silicone, 1998
K-3	WEST EEBA	2500/3500	General Electric	309	no change
L-1	LINAC	2500/3125	Westinghouse	550	To be replace w/silicone, 1998
L-2	LINAC	2500/3125	Westinghouse	550	To be replace w/silicone, 1998
L-3	LINAC	1500/1725	Westinghouse	282	To be replace w/silicone, 1998
M-1	912	2500/3125	Westinghouse	550	To be replace w/silicone, 1998
M-2	912	2500/3125	Westinghouse	550	To be replace w/silicone, 1998
M-3	912	2500/3125	Westinghouse	550	To be replace w/silicone, 1998
M-4	912	2500/3125	Westinghouse	510	move to 927
M-5	912	2500/3125	Westinghouse	510	Below SCDHS Limits
M-6	912	2500/3125	Westinghouse	510	Below SCDHS Limits
M-7	912	2500/3125	ITE	420	move to RHIC
MG	928 IN RF YD	2500/3125	Westinghouse	550	containment
MPS PS	NO. END 912	4825	ITE	1580	Upgrade containment, 1998
MPS PS REG	NO. END 912	4800	PENNSYLVANIA	1150	Upgrade containment, 1998
N-5	top of 927	2500/3125	ITE	420	Below SCDHS Limits
N-7	behind 919B	2300/2575	Westinghouse	467	Below SCDHS Limits
P-1	912A-WEST	2500/3125	Allis Chalmers	715	To be replace w/silicone, 1998
P-2	912A-WEST	2500/3125	Allis Chalmers	715	To be replace w/silicone, 1998
R	928 IN RF YD	2500/3125	Westinghouse	550	containment
SB-1	911	3000/3750	Westinghouse	1482	To be replace w/silicone, 1998
SB-2	911	3000/3750	General Electric	495	To be replace w/silicone, 1998
SUB 925	BL 925	750	RTE	218	Below SCDHS Limits
Siemens P1	Siemens yd		Siemens	2500	Upgrade containment, 1998
Siemens F1	Siemens yd		Siemens	1800	Upgrade containment, 1998
Siemens P2	Siemens yd		Siemens	2500	Upgrade containment, 1998
Siemens F2	Siemens yd		Siemens	1800	Upgrade containment, 1998
New RF # 1-11	New RF yard	11 trans	NWL	3300	containment
Booster MMPS	930A yard	30 trans	NWL	13600	containment

old Cyclo	928		Siemens	400	retire 98
Cyloconverter	928	1620	Trafo-Union	643	Upgrade containment, 1998
old RF	928		ITE	400	Upgrade containment, 1998

AGS Release Points Committee

Report #10 The AGS Recharge Basins and Wells:

Facility description:

The AGS has three active storm water recharge basins and an additional basin to collect the well water used for indirect cooling. Also included in this report are the three wells which provide process cooling water for the AGS. In addition there were two other recharge basins which were moved because of expansion of the AGS complex. All of the basins are open and accept surface water discharges. Their primary purpose was to take rain water run-off from the roofs and concrete/asphalt tarmacs throughout the AGS. Most of the original buildings in the AGS and many of the buildings added in the 1960's and 1970's had floor drains connected to the same storm water basins. Details of the floor drain discharges are described in the other AGS reports. In the 1990's a program was initiated and carried out to reroute many of the floor drains from the storm water system to the sanitary system. As detailed in our action item list, more buildings need to be added to this conversion.

Facility Buildings/Basins:

915	AGS well house #1
916	AGS well house #2
917	AGS well house #3
AGS Well Water Recharge Basin	
912	Recharge Basin (abandoned and buried)
919	Recharge Basin
927	Recharge Basin (abandoned and buried)
930	Recharge Basin
ISA/RHIC	Recharge Basin

Related Buildings:

The AGS facility discharges to these basins as shown on the map.
The RHIC shop area 902/905 presently discharges storm water to the 930 basin.
The graphite reactor facility buildings 701/703/801 presently discharge to the ISA/RHIC basin.

Well house issues:

Buildings 915, 916, and 917 are wells used to provide approximately 800 to 1100 gpm of cooling water to AGS magnet cooling system in Building 911. All three facilities are similar and each facility consists of a pump room, two chemical storage rooms, an isolation valve (located adjacent to the pump house), and a transformer yard. A pipeline, which starts near Building 917, runs past all three wells and continues to the AGS. Well #2 (916) normally provides all the water needed, but wells #1 and #3 (915 and 917) can be used instead when #2 is not available. The pump rooms are concrete buildings approximately 5 feet below grade and 3 feet above grade. They contain the well pump, piping, and valves. Metered chemicals are added to the water (at the pump) as the water is pumped out of the ground. The pump room has a exhaust fan which runs whenever the light switch is turned on. There is one floor drain (approximately 1 foot square) in each pump room. The drain discharges to the ground under the pump-house floor. The surface of the concrete floor show indications of previous chemical spills (stains and corrosion of

concrete surfaces) and a flow path of those spills to the floor drain. The floor drain is a potential pathway for spills which might occur in the future and is on the action item list..

The chemical storage rooms are integral manufactured units with double walls and built-in secondary containment in the form of a double floor under the rooms. These were installed recently to prevent spills of chemicals to the soil. Drainage to the secondary containment from the storage room is provided by an open grid running across the full width of the room. The secondary containment capacity is 625 gallons, based on planned storage of 520 gallons of chemicals plus 20 percent. Each room is equipped with an exhaust fan which starts automatically when the door opens. One chemical storage room at each well is used to store Sodium Hypochlorite, a liquid form of chlorine treatment. The second chemical storage room at each well is used for storing containers of Drewsperse antifoulants. Unusual Occurrence Reports and level 3 forms for these buildings described past chemical releases of chlorine from gas cylinders. A liquid form (stored in these new buildings with secondary containment) is used at this time to prevent future occurrences.

The transformer yard which supplies power to the pump house contains three oil-filled transformers which are labeled "Non-PCB" and are in a diked sump typical of the age of the facility. There is no path for drainage from the diked sump except to the ground.

The AGS Well Water Recharge Basins:

The AGS Cooling Water pumped from the well houses described above continue to drain to the original AGS cooling water recharge basin. This basin (not shown on our sketch) is located on the south side of East Fourth Avenue, south of Building 870, which appears to be part of the Waste Management Facility. The secondary water discharge is covered in the Cooling Water Systems Report #7.

Recharge Basins - 912, 927, and ISA/RHIC:

The 912 basin was the original recharge basin for the AGS facility. It does not appear on any of the old camp Upton drawings or photographs. The present storm water piping drawings show that the ISA/RHIC basin which eventually replaced this basin takes storm water from the old graphite reactor complex (building 701/801) parking lots and roofs. Whether this was the case back in 1960 and is not known. During an expansion of building 912 this basin was filled in and the plumbing was extended out to the end of the U-line/building 927 complex and an open basin was dug there. This basin served the facility until 1979 when ISAbelle, now RHIC, construction required the basin to be moved farther north. Its present position is inside of the RHIC ring road.

Because the intensity of the AGS was low in the 1960's the original 912 basin would not have received very much activated water from leaks and spills. The concern would be chemical solvents lost to floor drains, oil from the bubble chamber hydraulic equipment, lubricating oils, and water treatment chemicals as detailed on the building level 3 sheets. The 927 basin probably received the discharge from the Siemens (building 928) which is now estimated at <100 gallons of oil and <90 gallons of TCA for the clean-up. The intensity of the AGS was higher in those years so the level of water activation was higher as well. The neutrino horn (building 927) began operation in 1973. Its target water was activated and would have been lost to this basin. The ISA/RHIC basin has been taking discharges from 1979 to the present day.

The 919 basin:

The storm water run off from the 919 complex (919, 919A, B, C, G , 975) is piped to a wooded recharge area north west of building 975. No documentation on when this area was first used exists. The adjacent buildings date back to 1962 but the 912 recharge basin may have been used until it was cut off by the U-line in the late 1960's. The only major known release is the tritium from gas chromatograph failure in 1973 which contained 250 mCi of tritium (see PERP report #5, building 919). How much was released is not known. It was cleaned up by washing down the contaminated parts with water. The run-off from this incident would have gone to this basin or the 927 basin. The 919 basin also takes water from the 919 floor drains which may have received oil from bubble chamber hydraulic system leaks.

The 930 basin:

The 930 basin takes water from the floor drains on the upstream end (west end) of building 930 and the mechanical equipment room of building 930 as well as run-off from the roof drains on building 930 and the parking lot. Both sets of floor drains can and have taken activated water as listed on the building 930 level 3 sheets. Also in the 1970's and 1980's water treated with chemicals was released to the floor drains. Because of these releases the recharge basin was studied. The water system maintenance procedures were modified in 1990.

Documents Reviewed:

1. "Historical Site Review Report", IT Corp., 1993
2. (Draft) 1995 Site Environmental Report, Safety and Environmental Protection Division, Brookhaven National laboratory, December 1996
3. State Pollutant Discharge Elimination System (SPDES) Discharge Permit, Special Conditions (Part I) (SPDES # NY-0005835), New York State Department of Environmental Conservation, Issued 03/01/95
4. Occurrence Report No. CH-BH-BNL-AGS-1991-1005, Accidental Release of Chlorine to Atmosphere. 03/04/1996
5. Unusual Occurrence Report No. 85-28, 1,000 Gallon Leak of Drewsperse, 10/14/1995
6. Occurrence Report No. CH-BH-BNL-AGS-1991-0002, Chlorine Gas Leak From 150 lb. Cylinder, 03/04/1996 (Final)
7. Occurrence Report No. CH-BH-BNL-AGS-1991-1002, Chlorine Gas Leak From 150 lb. Cylinder, 03/03/96 (final)
8. Occurrence Report No. BNL 91-017; AGS 91-002, Chlorine Gas Leak From 150 lb. Cylinder, 03/15/1991.
9. S&EP Monthly Report, W.R. Casey September 1973.
10. Siemens/AGS Power Supply Operating Log Book.

Drawings Reviewed:

1. Dwg. No. 7966-A1, AGS - Chemical & Chlorine Storage - Location Plan, 11/1/93
2. Dwg. No. 7966-A2, AGS - Chemical & Chlorine Storage - Floor & Foundation Plan, 11/1/93
3. Dwg. No. 7966-ME1, AGS - Chemical & Chlorine Storage -Electrical/Mechanical Plan, 11/1/93
4. Dwg. No. 921211-FB-1C, AGS - Yard Piping, 9/11/56
5. Sanitary System Map, Sector No. 63, 1992

6. Storm Drainage Map, Sector No. 63, 1992
7. Camp Upton Storm Drains and Soil Erosion Control map, Drawing No. U-3-A, 02/05/43
8. Sewerage-Drainage map, No. 45, 1989
9. Sewerage-Drainage map, No. 44, 1989
10. Water and Gas map, No. 45, 1989
11. Water and Gas Map, No. 44, 1989
12. Stone & Webster Drawing No. 9212.11-FB-1B, "Yard Piping - Sheet 2," dated March 6, 1957. (912 Basin)
13. Drawing C-36 (Sheet No. 36), "Partial Grading and Drainage Plan," January 15, 1979 (927 basin)
14. Drawing C-41 (Sheet No. 41), "Partial Grading and Drainage Plan," January 15, 1979 (927 basin)
15. Drawing No. AM 1.3306-A, "Drainage Map - Central Area," Rev. 6, December 1964. (AGS cooling water recharge basin).

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